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# SPICE PLANTS IN ETHIOPIA: THEIR CULINARY AND MEDICINAL APPLICATIONS



FEKADU FULLAS, RPH, PHD

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## Preface

Plants have been used by humans for a variety of purposes. They have been used as foods, spices (condiments), medicines, ornaments, fodders, fuel, and construction materials. They can be collected from the wild, or cultivated in crop fields, home gardens, or in modern large-scale plantations. Food crops in Ethiopia are estimated to be well over a hundred. About 650 plant species have been documented as being used for medicinal purposes. Most Ethiopian spice plants have the dual purpose of imparting flavor to foods and beverages, and serving as traditional medicinal substances. Over 30 plant species are known to be used in Ethiopia as spices.

Spices are important ingredients of Ethiopian foods and beverages. One cannot imagine Ethiopian foods and beverages without spices, be it in different types of *wot*, bread, *tella*, *tedj*, or *arake*. Spices have, however, more than culinary importance. Depending on how and how much they are used, they also form part of the medical folklore. This dual role of spices makes them even more important.

It therefore goes without saying that spices play a significant role in Ethiopia, as elsewhere, in food systems as additives, in medical folklore as medicinal herbs, and on certain occasions as fragrances. The history of spices is intertwined with that of the development of society. It is filled with amazing accounts, daring adventures, and curious legends. Since time immemorial, many spice plants have been used as flavorings in foods and beverages, and as medicinal and fragrant substances. In recent years, a significant number of reports have appeared in the scientific literature, particularly in the West, elucidating the attributes of spice plants as herbal remedies. This book touches in varying details on the aforementioned aspects of Ethiopian spice plants.

Ethiopian foods are known for their spicy taste. The spices used are plant-derived, and most of them are also used universally. When used in larger quantities, most of the spices have medicinal values. The latter benefits are mostly overlooked, or underappreciated. The main purpose of this book is, therefore, to

provide both the culinary and medicinal aspects of over 30 spices used in Ethiopia. Most of these spices are also used in various countries outside of Ethiopia. The general aspects and more common uses of these spices around the world are given as a background in each monograph, interspersed with their geographic distribution and particular use in Ethiopia. Although frankincense (*etan*) and myrrh (*kerbe*) are not strictly spices commonly used in foods, they are included, due to their economic and religious significance. Most of the information included in this book has been extracted from credible primary and secondary literature sources. For the sake of convenience, these references are placed at the end of each chapter, and in the case of Chapter IV at the end of each spice monograph.

The first thorough work on Ethiopian spice plants was published in 1981 by Jansen, which is extensively cited in this book. Since the publication of this important book, no comprehensive work has appeared, especially one that would link up existing literature on spice plants in Ethiopia with current scientific reports. This book attempts to bridge that gap.

The compilation is not intended to serve as a cookbook, nor as a self-medication guide. The former need is met better by consulting pertinent cuisine books, and by following established culinary practices. In another respect, as will be evident in this book, spice plants have been used in Ethiopian traditional medicine as herbal remedies to treat various maladies. As conventional (orthodox) medicine advances, so does traditional medicine, not to the exclusion of the former, but in tandem with it. Herbal medicine should complement so-called Western medicine, particularly in technologically backward societies. The golden days of reinvigorated traditional medicine may still be on the horizon. With the progress of natural products chemistry and allied disciplines, the best of herbal medicine is yet to come. In this respect, Ethiopian spice plants are just a minute slice of a much larger pie of traditional health care. It should be pointed out, nevertheless, that some traditional medical claims may be exaggerated and lacking in evidence, while other remedies may have some scientific justification, or may require well-designed further research.

The reader is encouraged to make informed determination based on available facts presented herein. The author does not endorse self-treatment by using the information provided in this book, especially in complicated clinical conditions, which should be managed only through the intervention of qualified health professionals.

While writing this book, the author has kept in mind the range of readership who may potentially benefit from it, and he has tried to maintain a balance between the extent to which the technical and non-technical aspects are treated. He hopes scientists, health professionals, and lay readers alike can benefit from this compilation. Finally, it should be stated that this book is far from being complete and error-free.

## ◆◆◆ Chapter I ◆◆◆

### What are spices?

In ancient times, spices were used more as ingredients of incense, embalming preservatives, perfumes, cosmetics, and medicines than they were employed to flavor foods and beverages. It was only after the first century A.D. that they became more popular as flavoring agents in foods and beverages.

Spices have been defined in various ways, depending on the intended focus. Some definitions lack precision and leave out important features. The term "spices" has been used interchangeably with terms like culinary herbs, seasonings, condiments, and flavorings. Spices may be defined as plant products used in flavoring foods and beverages. Most of them have the additional advantage of possessing medicinal properties.

In general usage, "spice" is a culinary term. It does not pertain

to any specific botanical category, nor does it refer to a certain plant part. Spices may originate from herbs, shrubs, trees, and plant parts such as roots, barks, leaves, flowers, seeds and fruits. Cookbooks generally distinguish between seasonings (spices used during the process of food preparation) and condiments (spices added by the consumer after food is served), but not between herbs and spices.<sup>1</sup> Customarily, the term “spices” refers to products like cinnamon and pepper, which are obtained from woody plants, while prepared products like ketchup and mayonnaise are considered as condiments.<sup>2</sup> Although they are used in seasoning, sodium chloride (the common table salt) and monosodium glutamate (MSG) are not considered as spices. They are, however, flavor enhancers.<sup>3</sup> Other definitions restrict spices to plants in certain climatic zones, habits of plants, or plant parts. For example, culinary herbs have been defined as the leaves of fresh or dried plants, while spices have been associated with buds, fruits, berries, roots, or bark, usually dried, that are derived from plants which grow in tropical regions.<sup>4</sup>

In the botanical context, herbs are defined as plants that do not possess woody tissue, as shrubs and trees do,, and can be annual, or perennial, depending upon how long their roots survive. In traditional medicine, herbs assume a different meaning. They refer to any plant (herb, shrub or tree) or plant part that is used in folklore as a medicinal agent.<sup>5</sup> Herbs that are used in foods may be termed appropriately as culinary herbs. If a plant has culinary use only, or both culinary and medicinal uses, it may be referred to as a spice.

A rather sweeping distinction some people make between an herb and a spice is by referring to any plant product that is green as an herb, while reserving the name ‘spice’ to any brown, red, orange, black, or any non-green culinary product. A more complete definition considers a spice to be any tropical aromatic plant part, or the dried seeds and fruits of temperate plants used to flavor foods.<sup>6</sup>

Based on the plant parts they are obtained from, their unique properties, or the plant families they are obtained from, a classification scheme of spices has been suggested.<sup>7</sup> Some examples follow:

**Plant parts:**

Flower buds: cloves.

Fruits: allspice, black pepper, and nutmeg.

Underground stems: ginger and turmeric.

Barks: cassia and cinnamon.

Seeds and seed-like structures: anise, caraway, cardamom, coriander, and dill.

**Plant Families:**

Brassicaceae (Mustard Family): mustard.

Umbelliferae [Apiaceae] (Carrot Family): anise, caraway, coriander, cumin, dill, and fennel.

Labiatae [Lamiaceae] (Mint Family): basil, marjoram, mint, and thyme.

Lauraceae (Laurel Family): cassia and cinnamon.

Liliaceae (Lily Family): garlic, onion, and shallots.

Zingiberaceae (Ginger family): cardamom, ginger, and turmeric.

**Properties:**

Stimulating: black pepper, capsicum peppers, garlic, and mustard.

Aromatic: anise, cardamom, cinnamon, cloves, and ginger

Sweet: basil and fennel.

In this book, the term “spices” is often used to refer to culinary herbs, condiments, seasonings and flavorings, that have the dual properties of adding flavors to foods and/or beverages and having use in folkloric medicine. Some of the plants treated herein have more culinary use than medicinal use, while the converse is true for other plants. Although they are hardly used as food flavorings in Ethiopia, frankincense and myrrh are included because of their economic, religious and medicinal significance.

## The Chemistry of Spices

The chemical constituents of spices that are responsible for their distinct taste and aroma are known by the general name secondary metabolites or compounds. Contrary to primary metabolites which have metabolic function in plants, secondary metabolites do not have such apparent function. Instead, they play ecological roles such as pollinator attractants and as chemical expression of adaptation to environmental stresses. They also serve as chemical defenses against microorganisms, insects, higher predators, and other plants. It is thus no wonder that most spices have antimicrobial properties. Secondary metabolites are found in specialized cells of plants, and occur in smaller quantities than primary metabolites. In general, they are higher value-lower volume products.<sup>8</sup>

Spices owe their taste and fragrant (aromatic) qualities to substances known as essential oils contained in different parts of odoriferous plants of their origin. Essential, because they are responsible for the unique "essence" or aroma that a particular plant exhibits. These chemicals are also called volatile or ethereal oils.<sup>9</sup> All aromatic plants are not necessarily used as spices. The names essential oils, volatile oils and ethereal oils perhaps do not adequately convey as much chemical meaning as they do physical characteristics.

In the physical sense, volatile oils evaporate when exposed to ordinary room temperatures, have distinct aroma, and are generally insoluble in water, but are extractable into organic solvents. However, they are soluble enough in water to impart odor and yield what are known as aromatic waters. Unlike fixed oils (glyceryl esters of fatty acids), volatile oils do not leave a permanent greasy spot on paper, nor are they saponifiable by alkalies. On long standing, they are susceptible to oxidation and resinification. Because of these undesired chemical changes, which result in deterioration and poor qualities, spices should be stored in a cool and dry place in a tightly closed amber glass containers to increase their shelf life.<sup>9</sup>

Chemically, for the most part volatile oil constituents are

terpenoids, or phenylpropanoids. The terpenes found in volatile oils are usually monoterpenes with a 10-carbon skeletal framework. They may have various cyclisation and oxidation patterns, as well as different degrees of unsaturation. On the other hand, phenylpropanoids are aromatic, having phenyl moieties in their structures. Examples in this class of volatile oil constituents are cinnamaldehyde and eugenol from cinnamon. Volatile oils are complex mixtures of hydrocarbons, alcohols, ketones, aldehydes, ethers, oxides, and other derivatives. They consist of the liquid hydrocarbon portion called "eleoptenes" and the solid oxidized hydrocarbon portion, called "stearoptenes." However, exceptions are not uncommon. For example, eucalyptol, eugenol, and methyl salicylate are liquid oxygenated hydrocarbons. Substances like menthol, thymol, and anethole are examples of solid stearoptenes.

The taste or smell of volatile oils is a result of their interaction with receptor sites. In order to elicit specific olfactory response (aroma), volatile oils in spices need to meet specific structural requirements, including geometry (e.g., *ortho/meta/para* or *cis/trans* configuration) and spatial orientations (stereochemistry). Different kinds of olfactory (smell) sites exist in the nose tissue. These receptor sites require strict stereochemical configurations of spice constituents to effect the required fit, so that a given odor response is produced. For example, (+)-carvone produces the specific odor of caraway, whereas (-)-carvone elicits spearmint odor.<sup>9</sup> Although a specific aroma of a spice is ascribable mostly to the major volatile constituent(s), the multiplicity of volatile oil constituents doesn't allow the assignment of a given odor to any single compound, which makes drawing taste (aroma)-chemical structure relationships rather complex. In an analogous manner, theories have also been put forth for the elicitation of taste response, especially for sweet substances. Whether a single site or multiple binding sites within a receptor molecule on the papillae of the tongue are involved in initiating taste response is still open to debate. However, various studies on sweet substances have indicated that they require binary groups in their structures, which bind through a hydrogen-bonding mechanism with

corresponding reciprocal units on the protein structures of the receptor molecules on the papillae of the tongue to evoke a sweet sensation.<sup>11,12</sup> This theory may apply in part to taste profiles that spices exhibit.

### An Overview of World History of Spices

The history of spices goes back to several millennia. Spices have a fascinating account covering a considerable portion of human history. They have been a reason for risky sailing adventures across turbulent seas to thitherto undiscovered lands and traitorous long caravan routes on land. Wars have been waged for the sake of controlling the sources and trading of spices. Almost each spice has its own unique history. Wherever applicable this facet of spices is amplified in the pertinent section of the respective monograph of each spice. In this chapter, an overview, *albeit* by no means exhaustive, world history of spices is given. Each stage of this history is given chronologically, starting with the earliest period. Only important features are included for each period. They are summarized from two major references.<sup>12,13</sup>

The earliest Chinese treatise, *The Classical Herbal (Pen Ts'ao Ching)*, in Chinese) is thought to have been written around 2,700 B.C. The treatise included over a hundred plants, including the spice cassia. However, the dating of the document is a suspect. Modern scholars believe that it might date back to only several centuries B.C. In later authentic documents, the spices cassia and ginger are mentioned. Nutmeg and cloves, which are native to the Moluccas (Spice Islands), were introduced into China at an early date.

The Egyptian Pyramid Age is dated about 2,600 to 2,100 B.C. It is during the construction of the Great Pyramid of Cheops that the first use of spices is recorded. Tens of thousands of laborers working on the construction were fed onions in the hope that they would stay healthy to complete the work. During this period, the Egyptians used cassia, cinnamon, cumin, and anise to embalm the bodies of their great pharaohs. The spices provided fragrance to otherwise foul

smelling remains. By so doing, the Egyptians would also appease the "gods of death". Most of these spices were not indigenous, but were brought into Egypt from China and Southeast Asia. The upper classes of Egypt burned aromatic gums to ward off evil spirits, and to neutralize the bad smell emanating from low class people. Egyptian women used to carry wax-like fragrant pellets in pouches as perfumes. These pellets were made from the gum of Bdellium (*Commiphora mukul*) which was probably obtained from India.

A comprehensive scroll measuring about 65 feet long, dated about 1559 B.C., was discovered in 1874 by the German Egyptologist Georg Ebers. The impressive Ebers Papyrus listed about 800 medicinals and spices, such as anise, caraway, cassia, coriander, fennel, cardamom, onions, garlic, thyme, mustard, and fenugreek. Egyptians used the aromatic spices as drugs, perfumes, cosmetic ointments, for cooking, and above all for embalming.

During the 2<sup>nd</sup> and 3<sup>rd</sup> millennia B.C., Arabia Felix, "Fortunate Arabia" (today's Saudi Arabia, Iraq, Syria, Jordan, Lebanon, and Israel combined) served as an area for the passage of spices from the East to the West. The Arabs reaped huge profits from the sale of the translucent amber-colored gum, which ignited and produced a pleasant odor when burnt. The gum was obtained from its plant of origin, a *Boswellia* species which grew abundantly in the valleys of Hadramut and Dhofar in Arabia. The valuable product was transported northward via the so-called Incense Route to the local markets of Egypt and Syria. Donkey caravans were used to transport the merchandise along this route. Later, around 1,000 B.C. they were replaced by the more enduring camels.

The scriptural aromatic substance myrrh was transported to Egypt from the Land of Punt in eastern Africa. Cassia and cinnamon were brought to the East African coast from China and Southeast Asia along the Cinnamon Route, and then northward. Another important route that Arab camel caravans used to transport spices was the Silk Road, which started in China and India through Persia (now Iran) to the port city of Antioch (now Antayka in Turkey). Arabian traders never revealed the source of cassia and cinnamon, but rather

fabricated fancy stories about their origin. They did this precisely to discourage the Mediterranean traders from dealing with China, India and Southeast Asia directly. That way they wouldn't be cut out of the loop and lose huge profits.

Part of the 1<sup>st</sup> millennium B.C. saw the contributions of Mesopotamia and India to the spread of spices. In the Tigris and Euphrates valleys of Mesopotamia, ancient writings which listed many aromatic plants were found. During the reign of King Ashurbanipal of Assyria (668-633 B.C.), a cuneiform writing was found which mentioned spices like thyme, sesame, cardamom, turmeric, garlic, cumin, anise, coriander, dill, and myrrh. The Assyrian royalty is said to have used huge quantities of perfume and aromatic products obtained from these spices. In neighboring Babylonia (720-710 B.C.), many spice plants were cultivated. These included cardamom, coriander, garlic, thyme, saffron, and turmeric. In the 6<sup>th</sup> century B.C., onions, garlic, and shallots were popular in Persia. During the 5<sup>th</sup> century B.C., King Darius of Persia is said to have received over 60,000 pounds of frankincense from the Arabs as annual tribute.

India is believed to be the original home of long pepper, black pepper, cinnamon, turmeric, and cardamom. Turmeric and cardamom were cultivated as far back as the 8<sup>th</sup> century B.C. in the gardens of Babylon, a fact which indicated that they were introduced to Babylonia from India much earlier. In Ayurvedic medicine, references are made to many spices as herbal remedies. The medical writings of Charaka and Susruta II mentioned herbs and spices that were used as early as about 500 B.C.

The period 331 B.C. to 641 A.D. witnessed an increase in the use of spices among the Greeks and Romans. The ancient Romans imported spices like pepper, cassia, cinnamon, and ginger from the East. Anise, caraway, poppy seeds, fennel, coriander, and garlic were also used in the kitchen as culinary products. Hippocrates, Theophrastus and Dioscorides all mentioned spices in their writings.

During the time of Pliny in the 1<sup>st</sup> century A.D., the use of spices as condiments boomed in the Roman Empire. The cost of

pepper and other spices skyrocketed, because of the monopoly of the market by the Arabs. The Romans tried, but in vain, to incorporate the south Arabian spice kingdoms. Later, during the time of Emperor Claudius, the Romans were successful in sailing to India with the aid of the seasonal monsoon winds. By so doing, they were able to cut out Arab merchants, and put an end to the subterfuge Arabs made as to the origination of spices. The Romans were very lavish in their use of spices. They are said to have sprinkled huge amounts of spices along the path of the funeral procession of Commander Germanicus. They also used spices in foods and wines, as well as perfumes.

The Roman Empire began to crumble in the face of the invasion of the Goths from the northern side of the Alps. In 408-410 A.D., the advancing army of the Gothic king Alaric demanded 3,000 pounds of pepper from the Romans, so the army would not invade Rome, to which the Romans complied. Nevertheless, even after the Romans met the demand, Rome was overrun by Alaric. This signaled the beginning of the fall of the Western Roman Empire. However, the Eastern Roman Empire, with its capital at Constantinople (present-day Istanbul in Turkey), continued trading with the Moluccas, India, China, and Ceylon. Spices such as cloves, nutmeg and others found their way to the new capital of the Byzantine (Eastern Roman) Empire.

The period 641 to 1096 A.D. began with the rise of Islam and the Arabs taking over of Alexandria from the Romans. In his early years, Mohammed, the founder of Islam, was himself a merchant trading in frankincense, myrrh and other Oriental spices. His followers took over vast expanse of land stretching from the borders of China, the Malabar Coast of India in the East to Spain in the West. They brought the trade of spices under their control.

The following period 1096-1400 A.D. was the era of the Crusades. It started with the launching of the First crusade in 1096 A.D. The Crusaders conquered the Holy Land of Jerusalem, with the idea of driving out the Muslims. In Italy, the port cities of Venice, Genoa and Pisa flourished. Venetians built ships which transported the Crusaders across the Mediterranean. On their return, they took

back to Europe Oriental spices, such as pepper, nutmeg, cloves and other commodities. Pepper, cloves, cinnamon, and cardamon brought so much prosperity to Europe that they were said to have contributed indirectly to the works of Michelangelo, Titian, Raphael, and Leonardo da Vinci. Renaissance was in full swing.

In 1180 A.D., a pepperers' guild of wholesaler merchants was established in London, which much later in 1429 was transformed into a spicers' guild. The guild was entrusted with the task of managing the trade of spices, and sorting out medicinals. The original spicers and pepperers were the forerunners of the apothecaries, who in turn were the precursors of medical practitioners.

In the 1270s, Marco Polo set out from Venice on a trade journey that took him to Java, the Malabar Coast of India, and China. His purpose was to establish trade relations between Venice and the great Kublai Khan of Mongolia. In 1298, when a war broke out between Venice and Genoa, Marco Polo was taken to Genoa as a prisoner. While in confinement, he gave a vivid description of places he saw during his many years of travel in the East. In his memoirs, he recounted about pepper, nutmeg, cloves, and other valuable spices which grew in Java and other islands in the China Sea. He also told about the abundance of cinnamon, pepper and ginger in the Malabar Coast of India.

In 1460, a Portuguese ship reached west Africa and found a local spice called "grains of paradise," also known as Melegueta peppers (*Amomum melegueta*). Several years later, Bartholomew Diaz discovered the southern tip of Africa, the Cape of Good Hope. In 1485, Christopher Columbus (a Genoese from Italy) secured the support of the Spanish sovereign and sailed West to reach the spice-rich East. He led a fleet of three ships, *Santa Maria*, *Pinta* and *Niña*. He landed in the Caribbean Sea islands of San Salvador, Cuba, and Santa Domingo. Today, these islands are called the West Indies. Instead of the Oriental spices, he found chilli peppers, *Capsicum* species. Of course, the magnificent Chinese Empire with its marble bridges and mighty palaces, roofed with the finest gold, with floors

paved with two-finger thick gold, as described by Marco Polo, was nowhere to be seen. Destitute villages with palm-thatched huts inhabited by "Indians" were found instead. The New World and its hot capsicum spice were thus accidentally discovered.

In 1498, the Portuguese navigator Vasco da Gama successfully landed in India. The voyage took him from Lisbon around the Cape of Good Hope to the Malabar Coast of India, where the long-sought-after cinnamon, cloves, ginger, and pepper were aplenty. Thus, the center of spice commerce shifted from the affluent Venice to the flourishing harbors of Spain and Portugal. As a consequence, Venetian spice trade suffered tremendously. The discovery of direct sea route to the East led to an increased consumption of spices in Europe.

In 1519, the Portuguese navigator Ferdinand Magellan led a fleet of five ships in a westward direction around the globe to reach the East. Although he did not make it himself, his crew eventually reached the Spice Islands. The crew took back to Spain twenty six tons of cloves, scores of sacks of nutmeg, mace, and cinnamon, and a deck-load of fragrant sandalwood. Sebastián del Cano, who was the captain of the *Victoria*, one of the ships that took part in this expedition, was awarded a pension and a coat of arms that depicted cinnamon, nutmeg and cloves. In 1519, the Spanish conquistador Hernandèz Cortèz and his soldiers found vanilla in Mexico. In most of the 1500s, Portugal had control of the spice producing areas of the East-Ceylon, East Indies (Java, Sumatra and Borneo), and the Spice Islands (the Moluccas).

In 1605, the Portuguese began losing control of the Spice Islands. The Dutch took over from the Portuguese. Following the example of the British East India Company, the Dutch formed their own Dutch East India Company. The Dutch, however, employed ruthless methods of controlling the trade of spices. They burned down clove trees in order to create artificial shortage and drive up prices. They also imposed production quotas, and administered severe punishment to those who did not comply.

In the late 1700s, the French broke the Dutch monopoly.

Nutmeg, clove and cinnamon plants were smuggled out of the Dutch-controlled Spice Islands and were planted in French colonies. The British on their part took over Dutch territories in the East. The Dutch ports of India's Malabar Coast were conquered. In 1824, the Dutch and the British signed a treaty, by which the Dutch kept Malaysia, while England took India, Ceylon and part of Borneo. This arrangement continued until World war II. Today, Sri Lanka (former Ceylon) is independent. So are Indonesia and India. The former Spice Islands were part of Indonesia.

As outlined in the preceding pages, spices have played a pivotal role in the discovery of new lands, in shaping human history to a certain extent, and in commercial ventures across landmasses and seas. Indeed, the spices we use today in foods and as medicines have an amazing history behind them, which usually goes unnoticed.

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## ◆◆◆ Chapter II ◆◆◆

### A Brief History of Spices in Ethiopia

There are no detailed records available on the history of spices in Ethiopia. However, throughout the history of Ethiopia, during various periods there had been several allusions made to certain spices in scattered accounts. Most of these sketchy accounts pertain to the search and trade of spices like frankincense, myrrh, etc. In ancient times, frankincense and myrrh in particular were in high demand in Pharaohnic Egypt to honor the gods and embalm the dead. Myrrh was also a popular ingredient of Hebrew anointing oil (Ex. 30:22-24). Ancient Egyptian pharaohs from time to time organized great fleets, which went to the "Land of Punt" in search of these precious spices.<sup>1</sup>

A monument of Sahure during the fifth dynasty, 28<sup>th</sup> century B.C., records a large quantity of myrrh from Punt.<sup>2</sup> Another ancient

reference made to spices in Ethiopia is at the time of the famous expedition of about 1500 B.C., when the Egyptian pharaoh, Queen Hatshepsut sent a fleet of five sailing ships to the Land of Punt, which was also referred to as the Land of the Gods.<sup>3</sup> The Land of Punt probably refers to ancient Ethiopia, or the latter was part of the former. There are various speculations on the approximate geographical location of the Land of Punt. It may refer to present-day Eritrea, or the region which included present-day Eritrea, Djibouti, Somaliland, or the whole area south of Egypt along the Red Sea coastline.<sup>4,5</sup> At any rate, the expedition took back, among other items, myrrh trees, incense and cinnamon. These products were listed as "marvels of the country of Punt." An ancient record of the collection of items that the expedition took back to Egypt reads:<sup>1</sup>

*"All goodly fragrant woods of God's land, heaps of myrrh-resin, fresh myrrh trees,.....cinnamon wood, khesyt wood, ihmut wood, sonter incense,..... Never was brought the like of this for any king who has been since the beginning."*

The bark of cinnamon perhaps originated in China and southeast Asia. It may have been transported in primitive outrigger canoes following the archaic "Cinnamon Route" to Madagascar, whence it was taken to the East African coast, to its final destination of the Land of Punt. This contention is supported by the fact that cinnamon trees were not indigenous to the Punt realm. Carvings are seen to this day on the walls of Queen Hatshepsut's temple at Dier el-Bahri, which bear testimony to the ancient expedition to the Land of Punt. The queen wanted to establish a magnificent terraced myrrh garden in homage to the god Amon.<sup>3</sup> An oracle of Amon is also said to have recorded:<sup>6</sup>

*"I have given thee Punt. No one knows the way to the Land of Gods anymore; no one has gone up the terraces of incense, none among Egyptians. They have only heard tales of olden times repeated by word of mouth"*

Following these expeditions, during the reign of the pharaoh Amenhotep (1447-1420 BC), two Puntite chiefs were believed to have traveled to Egypt to exchange their goods, which included incenses.<sup>4</sup>

In the 10<sup>th</sup> century B.C., the Sabean kingdom had become a power in the Red Sea. Incense trade along both shores of the Red Sea brought prosperity to the Sabeans. About the same time, the power of the Hebrew kingdom of Solomon was also growing in the region. Ships sailed in the Red Sea on trade missions.<sup>6</sup> Around 950 B.C., the Queen of Sheba, Makeda made the much celebrated visit to Jerusalem to develop trade relations with King Solomon. She went to Jerusalem with a great train of camels loaded with spices, gold and other precious stones.<sup>7</sup> The abundance of the spices was such that it was with no equals (I Kings 10:1-13; II Chron.9:1-12). Out of this visit was born Ibn el-Hakim (later King Menelik I), thus starting the long-running Solomonic dynasty of Ethiopia.<sup>8</sup>

In the 3<sup>rd</sup> century B.C., the Habashat in collaboration with the Sabeans were trading spices and incense with Egypt. The alliance which also included the Hadramut was formed to resist the threat of the Parthians.<sup>8</sup> In the 1<sup>st</sup> and 2<sup>nd</sup> century B.C. the Habashat, also known as the Incense People or Aethiopians, controlled a greater part of what was known as the “Incense Land.” This land included a considerable portion of the fertile areas of Arabia, bordered by desert and steppes.<sup>9</sup> Glaser derived the name “Habash” from a Mahari word, meaning gatherers. He also derived *Aethopian* (*Itiopyavan*) from *aytob*, which meant “incense.” Mahra, a place in southern Arabia, was referred to as “the Frankincense Country.” Because of the repeated attacks of the Parthians from the east, the people from Mahara and Socotra in south Arabia, as well as those from Somaliland (the true frankincense country) were forced to retreat westward to the Tigrean highlands to lay the foundation of what was to become the powerful Axumite Kingdom.<sup>8</sup>

There is a biblical reference made to myrrh from ancient Ethiopia at the time of the birth of Jesus. The kings of Sheba (Saba) offered gifts to baby Jesus (Ps 72:10). The three gifts given to Jesus

by the Three Wise Men were myrrh, frankincense and gold. Legend has it that frankincense was given to baby Jesus by an Ethiopian king to symbolize sacrifice.

Around the 1<sup>st</sup> century A.D., the king of Axum Zosacles, also known as Za Hakel, had control over the entire Red sea coast, including the Berber country (present-day Somalia).<sup>10</sup> There were several ports through which Axum traded, the principal of which was Adulis. The Axumite realm via the “Berber Market Towns” of the ports of Avalites (Zeila), Malao (Berbera) and Mundus (Bandar Hais) exported spices like myrrh, frankincense and cinnamon. Commercial activities of Axum continued for a long time, thereafter.<sup>11</sup> A 6<sup>th</sup> century Egyptian merchant, Kosmos Indikopleustes, had noted these activities. During this time, traders from Alexandria and Elatic Gulf (Gulf of Aqaba) frequently visited Adulis. The Axumites exported various items to India, Persia, Arabia and the Eastern Roman Empire. The export items included frankincense and aromatic substances. On the other hand, pepper was brought back from the Malabar Coast of India.<sup>12</sup>

In the 7<sup>th</sup> century, the growing tide of Islamic invasions reduced the power of the Axumite Empire. The Ethiopians were forced back and confined to the hinterland, protected by the forbidding natural terrain of escarpments, plateaus and mountains. Commercial links were severed until the 15<sup>th</sup> century. Of this isolation period, Gibbon writes:<sup>6</sup>

*“Encompassed on all sides by the enemies  
of their religion, the Aethiopians slept near  
a thousand years, forgetful of the world by  
whom they were forgotten.”*

In the 15<sup>th</sup> century, Europeans, the Portuguese in particular, re-established relations with Ethiopia, and the isolation curtain was thus lifted. Once again, commercial activities were booming. At the local level, in the 16<sup>th</sup> century, Alvarez describes a market in the northern part of the country where salt, incense, pepper, camphor and other

articles were bartered. Many foreigners were present at this market.<sup>13</sup> During this period, the Yemeni port town of Aden was an important commercial center that linked Ethiopia with Arabia, Persia, and the East, including India. In 1517, the Venetian traveler Andrea Corsalis mentioned the importation into Ethiopia of merchandise such as a large number of spices, medicinal drugs, perfumes, and other products through Aden. Cloves, nutmeg, mace, and other commodities were also traded in Aden, which found their way into Ethiopia through Zayla and Berbera. This trading activity of the time was confirmed by the observation of Brother Raphael of Axum, who witnessed that “many spices” were imported into Ethiopia through the port of Aden.<sup>14</sup> In subsequent centuries, spices like myrrh, onion, red pepper, etc. were commonly sold in local markets.

The cultivated spice plants of Ethiopia reflect the long period of isolation in which the country found itself. Most of the spices that belong to the American and South Asia complexes (Table 1) were probably introduced by the Portuguese in the 16<sup>th</sup> and 17<sup>th</sup> centuries. Some plant names of South Asian origin are easily recognized by Europeans, suggesting that they may have been introduced recently, e.g., “*lomi*” for lime and “*jnjibil*” for ginger. *Rhamnus prinoides* (gesho) and *Aframomum korarima* (korarima) appear to be indigenous. The West Asian complex as a whole is very different in the nature and patterns of variation from the South Asian and American complexes. Some were introduced at an early date, long enough for them to develop endemic varieties.<sup>6</sup>

A French physician, C.J. Ponchet, who traveled in Ethiopia (1698-1700), mentioned several plants, among which were myrrh, cassia and tamarinds. The Scottish naturalist James Bruce in his journey to find the source of the Nile River in the years 1768 to 1773 studied the natural history of northern Ethiopia. He thus produced an impressive list of about 161 plant species, which included spice plants such as *Boswellia papyrifera*, *Coriandrum sativum*, and *Rhamnus prinoides*.<sup>15</sup> A German traveler, W.G. Schimperi (1837-1878) collected a lot of plant specimens from northern Ethiopia.<sup>15,16</sup> The spice plant *Thymus schimperi* was perhaps collected during this

Table 1. The origins of some spice plants grown in Ethiopia\*

American	South Asian	African	West Asian early introduction	West Asian late introduction
Chili pepper	Lime	<i>Rhamnus prinoides</i> <sup>+</sup>	Mustard	Cumin
Sweet pepper	Lemon	<i>Aframomum korarima</i>	Garden cress <sup>+</sup>	Rue
	Ginger	Fenugreek <sup>+</sup>		
	Cloves	Coriander <sup>+</sup>		
	Nutmeg	Onion <sup>+</sup>		
	Black pepper	Garlic		
	Basil			

\*Adapted from Ref. 6.

<sup>+</sup>Vavilov's Ethiopian center of diversity.

period.

Coming to more recent periods, the Ethiopian spice factory was established in 1971. The main focus of the factory was to extract oleoresin paprika from red peppers for export purposes. Although the factory has the capacity to extract ginger and turmeric, it is engaged more in the production of oleoresin, which is exported to Europe, North America and Japan. The only other spice extraction company is KAASK, which was just recently established. There are dozens of businesses available in spice trade in Ethiopia, but only ten are considered large exporters. Unprocessed cardamon, ginger, cumin seeds, pepper and chilies are exported by these enterprises.<sup>17</sup>

More recently, *Ariti Herbal Products* was launched with a store in Addis Ababa, and its ancillary *Ariti Herbal Garden* in Sebeta at the outskirts of Addis Ababa. This private company is primarily involved in the preparation of volatile oil-based medicinal and fragrant products. It has also export capabilities. It is perhaps the first of its kind, as far as private endeavor to promote herbal products is concerned. *Ariti Herbal Garden* cultivates a broad range of aromatic plants.<sup>18</sup> Although they are produced for medicinal use and as fragrances, the plants of origin of several of the products are also known to be used traditionally as spices in foods and beverages in Ethiopia. Thyme and clove are two examples which fall in this category (See individual monographs on these spices in this book.).

Official statistics are not always available on the extent of the use and export of spices in Ethiopia. In 1981, about 900 tonnes of spices, predominantly pepper, were exported.<sup>19</sup> The export of "incense gum" (frankincense) for the years 1981, 1982 and 1983 were 318, 831 and 1122 tonnes, respectively. Ethiopia was one of the major exporters of myrrh and frankincense in 1987. In a 1981 estimate, the potential production of olibanum (myrrh) was 23,000 tonnes per year.<sup>20</sup>

## Spices in Ethiopia

It is estimated that there are between 250,000 and 750,000

species of higher plants that occur on this planet.<sup>21</sup> About 50,000 plants have been used at one time or another for medicinal purposes.<sup>22</sup> Considering a conservative number of 250,000 higher plant species in the world, about 12,000 of these (5% of the total) are used as edible plants,<sup>23</sup> although 75,000 are believed to be edible.<sup>24</sup> Of the 12,000 plants which have been used as food, only 2,000 have been domesticated, while about 150 are commercially cultivated. It is also interesting to note that only about 30 plant species provide 90% of the world's food.<sup>24</sup>

In Ethiopia, there are between 6,000 and 7,000 higher plant species, out of about 500 (about 8%) are edible.<sup>23</sup> According to Asfaw and Tadesse, about 400 of these are wild or semi-wild edible plants, while 25% (over 100) are cultivated edible plants. Most Ethiopian spices are cultivated. They comprise about 12% (16 out of 127) of food crops grown in home gardens.<sup>25</sup> In a study of 203 edible wild or semi-wild plant species, Mesfin and Asfaw list 11 as spices, condiments or flavoring plants.<sup>23</sup>

In a study published in *Bioscience*, it was indicated that Ethiopia is one of the ten countries in the world where spices are used the most, in particular in meat-based recipes.<sup>26</sup> One cannot imagine Ethiopian food without spices. It is known for its unique and hot flavor.

Some spices are more important than others, both as culinary or medicinal products. Jansen lists 12 spice plants, and provides a detailed account of the taxonomy, husbandry, distribution, culinary and medicinal uses, and chemistry of these spices. Most of these spice species are grown in home gardens or cultivated as field crops. A few are collected from the wild. Many spices are sold in local markets along with other medicinal plants. In the countryside, they may also be sold in local markets known as *sauce markets* (*yewot gebeya*).<sup>27</sup> Most of the spices used in Ethiopia are also known worldwide.

A 1991 study of 50 spices, aromatic and medicinal plants in eastern Ethiopia indicated that a sizable number of local merchants were involved in the trade of spices, along with other aromatic and medicinal plants. A significant number of the plants (over 25) were

spices. Interestingly enough, some of the spices were either imported or smuggled from Asia or East African countries. For example, spice plants such as *Cinnamomum zeylanicum* (*qarafa*), *Elettaria cardamomum* (*heil*), *Piper longum* (*timiz*), and *Piper nigrum* (*undo berbere*) fall into this category. The study further indicated that capsicum (*berbere*), an *Allium* species (*shinkurt*), and turmeric (*ird*) were the most common spices found in all local markets, with each market in turn specializing in selling certain spices. For example, the markets in Dire Dawa and Harar were found to sell more of fenugreek (*abish*), *Foeniculum vulgare* (*ensilal*) and coriander (*dimbelal*), whereas the Jimma-Aggaro markets specialized in selling cardamom (*korarima*), ginger (*jnjibil*) and garlic (*netch shinkurt*). On the other hand, in Hosahina market, fenugreek (*abish*), caraway (*netch azmud*), garlic (*netch shinkurt*), and coriander (*dimbilal*) were more common. The authors attribute the predominance of one spice over the other to mainly the food habits, economy and ecology of the respective areas that the markets cater to.<sup>28</sup>

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## ◆◆◆ Chapter III ◆◆◆

### Notes on Dosage and Standardization

The discussion provided in this chapter applies not only to spice plants when they are used for medicinal purposes, but also to all other herbal products. It is noteworthy that wherever doses are mentioned in the individual monographs of each spice plant in this book, they are not to be taken as proven safe and efficacious dosages. Nor do they mean that the particular dosing regimens are used in Ethiopia. They simply imply commonly used typical doses that have been compiled from existing literature. They are taken from two major references,<sup>1,2</sup> which in turn rely on primary and secondary sources. No independent evaluation has been performed to determine the rationale for the dosing strategy in the original literature reports. Therefore, doses mentioned in this book, besides being the common doses employed by people, should serve also as a guide for further

investigation by researchers. This fact is even truer when one considers the lack of standardization of traditional as well as modern herbal formulation methods.

Standardization and dosing of botanical remedies start with authentication of the medicinal plant species. Whenever a researcher conducts a study on the chemistry, biological activity, medicinal uses of a plant, or undertakes formulation studies or clinical evaluation of a medicinal product, the correct identification of a given plant is a key step. Such studies must be always accompanied by what botanists call a "voucher specimen." This practice ensures that when future investigators work on a given herbal remedy, they can go back and compare their findings with those of others who worked on the same plant species. The voucher specimen serves the crucial purpose of a quasi-reference standard. A taxonomist who is preferably well familiar with the flora of a particular region should verify the correct scientific name. In a recent *American Society of Pharmacognosy Newsletter*, it was reported that from a survey of 100,000 peer-reviewed articles in reputable journals only in 12 to 18% of the papers the plants had verified identification.<sup>3</sup> If one were to glean information from these papers on the chemistry, biological activity, or medicinal uses of a given plant, the chance that the information might be misleading is about a staggering 80%! Therefore, the importance of correct plant identification as a key step in the process of standardizing and dosing of a botanical remedy is incontrovertible.

In Ethiopian herbal medicine literature, doses of many medicinal preparations are not usually given. If they are, they are ill-defined and incomplete as far as the source and amount of plant material, method (s) of preparation, dose, dosing interval and length of therapy are concerned. It has been reported that water, *tella* and *tedj* are used by Ethiopian traditional healers as a vehicle or solvent in the preparation liquid dosage forms of many remedies, followed by straining with a piece of cloth to remove particulate matter before use.<sup>4</sup> Endeavors by modern researchers to study this particular type of preparation for dosing and formulation studies should mimic the traditional technique. The use of aqueous and aqueous-alcoholic

(ethanolic) extracting solvents can approximate the traditional techniques. For example, extraction of the plant material with 5 to 10% ethanol can mimic the use of *tella* and *tedj* in traditional formulations.

In a study published as early as 1986, Worku Abebe pointed out that traditional dosage preparations in his study area (Gondar region) lacked accurate measurement, involved poor hygienic methods, and showed variability of plant source in the formulation process. Such practice is bound to lead to ineffectiveness, toxicity, or even death.<sup>4,5</sup> This situation may also be true to this day. Although the rigors of modern pharmaceutical practice are not to be expected of the Ethiopian traditional herbalist, this facet is mentioned to drive home the point that modern researchers must take this feature into account when they initiate a study on formulation and dosing.

In his study, Worku further noted that the dose administered by traditional healers depended on the age and weight of the patient, the progression of the illness, and pregnancy for females.<sup>4</sup> This is an interesting observation, since the dosing of conventional drugs used to be based on similar considerations. For example, even though it is not used for conventional drugs nowadays, the old mathematical dosage estimation for children relative to adult dose has been used in herbal dosing. This estimation is based on Clark's Rule, Young's Rule, etc. (See appendix II).<sup>6</sup> From current perspective, the general rule of thumb is to avoid the use of herbal remedies in children, pregnant women, critically ill patients, unless they are absolutely safe.

There are a variety of issues that should be considered relative to standardization, dosing, effectiveness, and safety of plant-based medicinal products. One of the major distinctions between traditional herbal medicines and conventional drugs is that in the former there is a wide variation in strength, and a broad range of purported effective doses. The strength of an herbal product depends *inter alia* on the method of preparation employed, regardless of the fact that the same plant species is used. In other words, two botanical products from the same plant species, or even from the same plant parts are not necessarily equipotent. The method of preparation

determines the concentration of the chemical constituents, which in turn affects the degree (intensity) of the desired physiological activity. In conventional drugs, the active component is precisely known, and the dosage is based on the amount of this substance incorporated in the dosage form. On the other hand, in medicinal plant preparations, the active component (s) may not be known, or if known, the method of preparation is not standardized.

Qualitative and quantitative standards for a botanical product can be set either chemically or physiologically, or by a combination of both. Chemical fingerprinting relies on a host of analytical techniques, such as thin-layer chromatography (TLC), infrared spectroscopy (IR), high-performance liquid chromatography (HPLC), and gas-liquid chromatography (GLC). HPLC and GLC are the most reliable, since they give high resolution of plant constituents. GLC can also be coupled with an ultraviolet-visible detector, or a mass spectrometer to provide additional data. The limitation of GLC is that it can be applied only to volatile oils, or compounds like sugars that can be chemically derivatized to volatile products. This method is useful when the desired pharmacological activity is due to volatile constituents. In the future, HPLC may emerge as a method of choice for all botanicals. IR is not diagnostic, and therefore not much useful. TLC is a simple method which can prove useful as long as there is a reference standard botanical product.<sup>7</sup> Another alternative that has been suggested is to standardize a product by using a biologically active marker compound (if known), or any other compound for which a sensitive assay can be applied using the techniques mentioned above. This approach assumes that all bio-relevant compounds responsible for the activity remain in the same ratio.<sup>8,9</sup> The process of initiating a clinical study in humans may have its own ethical problems and legal entanglements. However, if there is convincing anecdotal evidence of efficacy and safety of a botanical remedy, coupled with long usage and indication of safety in preliminary studies in credible peer-reviewed journals, performing clinical studies in humans may be a safe exercise. For example, although toxicity issues appear to be a concern, many taenocidal

plants which have been used in Ethiopian traditional medicine for a long time have been evaluated in humans for their efficacy.<sup>10</sup>

Considering the complexity of plant constituents, physiological methods may be the best way to set standards and evaluate the activity of a medicinal plant product thereof. In this case, the bioactive chemical constituents of the plant need not be known. The bioassay method employed should be simple, rapid and cost-effective. It should also be linked to the performance of the product in human clinical trials. The levels of the physiological effect of the products can then be compared.<sup>7</sup>

A practical method that has been suggested is to determine the presence or absence of phytoequivalence between two products obtained from the same plant species (and plant parts). In order to do this, first an extract is prepared and its activity determined by an appropriate pharmacological or clinical method, followed by chemical profiling. Other extracts fitting the qualitative and quantitative chemical profile of the reference material are deemed to be phytoequivalent, and hence pharmacologically and therapeutically equipotent.<sup>8</sup> Therefore, the application of this kind of standard makes herbal dosing more meaningful and rational. This situation equally applies to spice plants when they are used in doses appropriate for medicinal purposes.

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## ◆◆◆ Chapter IV ◆◆◆

### Monographs

The following abbreviations are used to designate the specific languages of vernacular names used in each monograph:

A = Amrinya

O = Oromiffa

T = Tigrinya

S = Somali

***Aframomum corrorima* (Braun) Jensen (comb. nov.)**  
**Family, Zingiberaceae**

**Common Name (s):** False cardamom, Gurage spice

**Vernacular Name (s):** Korarima (A, O); Orsha (Ghmira);  
 Ofio, Otiyo (Kaffina), heil, Habal-habashi  
 (Arabic)

**General Notes, History, and Legends**

The genus name *Aframomum* is composed from *Africa* and *Amomum*, the latter perhaps derived from the Arabic *hamma* which means ‘hot, warm’, indicating the pungency of the seeds. The specific epithet *corrorima* is derived from the vernacular name *korarima*. In the past, *korarima* was known by various botanical names; *Cardamomum majus*, *Amomum korarima* and *A. augustifolium*.<sup>1</sup>

*Elettaria cardamom*, also known by the name cardamom, was an article of Greek trade in the 4<sup>th</sup> century B.C. Imported from India, cardamom was one of the most important Oriental spices in the Roman cuisine. Cardamom was listed among Indian spices liable to taxation in Alexandria in A.D. 176.<sup>2</sup>

**Botany and Geographic Distribution**

*A. corrorima* is a perennial aromatic herb with scaly underground rhizomes and leafy stems. It reaches about 1 to 2 m high. The plant flowers from January to September, and the fruits mature about 2 to 3 months later.<sup>1</sup>

*Korarima* is indigenous to Ethiopia. It grows in the forests of Kefa, Sidamo, Illubabur and Wollega at an altitude of 1,700 to 2,000 m, in almost the same habitat as coffee. Although this spice plant grows in the wild, cultivation has been reported around Lake Tana, Eritrea and Gelemso.<sup>1</sup> It is noteworthy that true cardamom (*Elettaria cardamom* syn *Amomum cardamomum*) has been successfully cultivated in Ethiopia.<sup>3</sup>

## Chemical Constituents

The seeds of *korarima* contain about 1% to 2% volatile oil, the chief constituent being 1,8-cineole, which accounts for 35.1% of the total volatile oil content.<sup>1</sup> True cardamom has a comparable composition of volatile oil, including the cineole content.<sup>4</sup> Thus, cardamom oil, steam-distilled from *E. cardamomum*, contains cineole (26-40%),  $\alpha$ -terpinyl acetate (28-34%), limonene (2-14%), sabinene (3-5%), and linalyl acetate (2-8%).<sup>5</sup>

## Culinary Uses

True cardamom is used in all parts of the world to flavor foods.<sup>5</sup>

In Ethiopia, fresh or dried seeds of *korarima* are ground, mixed with other spices and used to flavor *wot*. They are also used to flavor coffee and tea. Bread is sometimes flavored with *korarima* seeds. Compared to other *Aframomum* species, it has a less peppery and pungent taste. It has a milder and sweeter flavor.<sup>1</sup> It is used in combination with other spices in the preparation of spiced clarified butter (*nitir kibe*).<sup>6,7</sup> Cardamom is also used to spice collards and cottage cheese (*ye gomen kitfo*)<sup>8</sup>: Also locally known as *ayib begomen*, this dish is particularly popular among the Gurages on special occasions.

## Medicinal Uses

The seeds of *korarima* are used in Ethiopia as a carminative, purgative and tonic agent.<sup>1</sup> In general, volatile oils are believed to have antiflatulent, virustatic, and motility-enhancing effects.<sup>5</sup> Hence, the medicinal uses of *korarima* are in agreement with some of these general properties.

It is important to compare the uses of *korarima* with those of *E. cardamomum* (true cardamom) seeds. The latter are used by people for dyspepsia, intestinal spasm, irritable bowel syndrome, common cold, cough, bronchitis, inflammation of the mouth and pharynx, liver and gall bladder complaints, loss of appetite, tendency toward infection, and flatulence. Cardamom (and perhaps *korarima* also) is

possibly effective in dyspepsia, but no reliable information exists for its effectiveness in other conditions.<sup>5</sup>

### Dosage and Adverse Reactions

The typical oral dosage of cardamom is 1.5 gm of the ground seeds daily.<sup>5</sup> The other reported dosage is 15 crushed seeds in  $\frac{1}{2}$  cup of water, which is drunk five times a day.<sup>9</sup> The usual dose of the tincture is 1-2 gm daily.<sup>4</sup>

In general, cardamon is devoid of toxicity, although allergic skin reactions have been reported in spice factory workers who were exposed to cardamom powder.<sup>9</sup>

### Summary and Comments

*Korarima* is an indigenous plant, which is used to flavor food and beverages in Ethiopia. It is also used medicinally for gastrointestinal complaints. The volatile oil constituents may be responsible for the medicinal activity of *korarima* seeds.

*Korarima* could be developed into an important article of commerce. It has demand as a spice in neighboring countries. It is one of the spice plants for which a comprehensive germplasm collection has been suggested, before its natural habitat (the humid natural forests of southwestern Ethiopia) is destroyed.<sup>3</sup>

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*Allium cepa* L.  
Family: Liliaceae

**Common Name (s):** Onion, shallots

**Vernacular Name (s):** Qey shinkurt

**General Notes, History, and Legends**

Onions were an important health food in ancient Egypt. Workers who labored on building the Great pyramid of Cheops were fed onions for this purpose. Onion is also one of the plants mentioned in Ebers Papyrus. In the 6<sup>th</sup> century B.C., onions and shallots were among the popular spices in Persia.<sup>1</sup>

**Botany and Geographic Distribution**

*A. cepa* is a perennial herb that grows to about 4 ft high, with 4 to 6 hollow cylindrical leaves. It has greenish flowers on a long stalk. The underground bulb is made of fleshy leaf sheaths forming a thin-skinned capsule. It is one of the leading vegetable crops in the world.<sup>2</sup>

In Ethiopia, the native land races of *A. cepa* are all shallots, with onion being a recent introduction. The native cultivated varieties may have well-developed bulbs, or no bulbs at all. In the latter case, the whole plant is chopped up and used as a vegetable also. *Qey shinkurt* is cultivated as a garden crop.<sup>3</sup> Genetic erosion has become a concern in areas where improved varieties are coming into use.<sup>4</sup>

**Chemical Constituents**

Onions contain 89% water, 1.5% protein, and vitamins B<sub>1</sub>, B<sub>2</sub> and C, along with potassium. They also contain volatile oils, sulfur compounds like thiosulfinate and cysteine sulfoxides, and dephenylamine. Prostaglandins have also been identified in onions.<sup>2,5</sup>

**Culinary Uses**

Onion is considered as food and condiment. In manufacturing,

the oil from onion is used as a flavoring agent in foods.<sup>5</sup> Dried onion is used as a condiment rather than as a vegetable. Various types of dried onion products are used in soups, Chinese foods, gravies, dressings, omelets, vegetables, Spanish rice, salads, and meats, just to mention a few.<sup>6</sup>

In Ethiopia, *qey shinkurt* is used in cooking. It is considered both as a spice and vegetable. It is one of the most versatile spices used in Ethiopian foods. It is an ingredient of *berbere*, and is incorporated in various types of *wot* and meat-based dishes.<sup>7</sup>

### **Medicinal Uses**

Onion is used for a variety of medical problems including loss of appetite, preventing atherosclerosis, for treating dyspepsia, fever, colds, cough, bronchitis, asthma, hypertension, diabetes, tendency towards infection, inflammation of the mouth and the pharynx, insect bites, wounds, light burns, furuncles, warts, bruises, as anti-flatulent, anthelmintic, and diuretic.<sup>2,5</sup>

The methyl and propyl derivatives of cysteine sulfoxide are responsible for onion flavor and its lacrimation effect.<sup>5</sup> The lipid and triglyceride-lowering effect of these compounds has been demonstrated in animal studies. In addition, there are research reports indicating antidiabetic and antioxidant (and therefore anti-cancer) effects of onion. There are also reports on the antibacterial and antifungal properties of onion. The thiosulfinate constituent may be responsible for these effects.<sup>2</sup>

In Ethiopia, the bulbs are warmed on fire and eaten three times daily to relieve headache on one side of the head.<sup>8</sup> The juice is also used to improve eye sight.<sup>9</sup> The paste prepared from the fried onion is used for unspecified eye problem.<sup>10</sup>

### **Dosage and Adverse Reactions**

The oral average daily dose is 50 gm of fresh onion, juice from 50 gm of fresh onion, or 20 gm of dried onion.<sup>2</sup> Two to 5 ounces of fresh onion (about 1/4th to 1 cup chopped onion) is ingested daily for cardiovascular effects. Alternatively, 1 teaspoon of onion juice

can be taken three to four times a day. A cough syrup is prepared by mixing the juice with honey. The fresh juice can also be applied to minor cuts and athlete's foot.<sup>11</sup>

Ingestion of large quantities of onion may cause stomach distress. It may also cause hand eczema upon frequent contact.<sup>5</sup>

### **Summary and Comments**

Onion is one of the commonest spices and vegetable products worldwide. Its wide ranging flavoring and medicinal properties make it a widely used plant. Well-designed studies have demonstrated onion to be relatively effective in reducing the risk of cardiovascular diseases by lowering blood lipid (cholesterol) levels. The sulfur compounds contained in onion have also been shown to reduce blood glucose levels, which is useful in diabetics. Furthermore, there is evidence on the usefulness of onion in asthmatic patients. It may also have antibacterial uses.<sup>12</sup>

In Ethiopia, although onion is used for headaches and eye problems, studies are not available to support these uses.

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***Allium sativum L.***  
**(Family: Liliaceae)**

**Common Name (s):** Garlic, Allium, Stinking Rose, Nectar of the Gods, Rustic Treacle, Camphor of the Poor, Man's Treacle

**Vernacular Name (s):** Netch shinkurt

**General Notes, History, and Legends**

The name *Allium* is derived from the Celtic word “*all*” which means burning or smarting. Garlic was a valued commodity in ancient Egypt. Inscription on the Cheops pyramid attest to this value and usefulness.<sup>1</sup> After they fled Egypt along the way to the Promised Land, the Israelites were said to have lamented about not being able to eat onion. In Numbers 11:5, they say:

“We remember the fish, which we did eat freely; the cucumbers and the melons and the leeks, and the onions and the garlick.”

There is also a legend in Mohammedan tradition that mentions, when Satan walked out of the Garden of Aden after the fall of man, garlic popped up where he landed his left foot, and onions sprang up where his right foot touched the ground. Roman laborers ate garlic commonly, and furthermore Roman soldiers used to eat garlic hoping it would make them courageous in wars.<sup>2</sup>

**Botany and Geographic Distribution**

Garlic is a perennial bulbous plant, with a tall stem that grows to 2 to 3 ft. It produces pink to purple flowers.<sup>1</sup> The garlic bulb is a compound bulb, which is covered with silky white or green skin.<sup>3</sup> It has a strong odor.<sup>1</sup> Garlic is considered to have originated in Central Asia, and later introduced to the Mediterranean region. It is cultivated worldwide.<sup>3</sup>

Like *qey shinkurt* (shallots; *A. cepa*), *netch shinkurt* (garlic; *A. sativum*) was introduced into Ethiopia long time ago. Garlic is regarded both as a spice and vegetable.<sup>4</sup>

## Chemical Constituents

Garlic contains vitamins, minerals, and trace elements (germanium and selenium). Of all *Allium* species, *A. sativum* (garlic) contains the highest sulfur content.<sup>1</sup> Upon crushing or cutting garlic bulb, the odorless, colorless, sulfur-containing amino acid constituent allin is readily transformed by enzymatic action to the pungent compound allicin.<sup>1,3</sup>

## Culinary Uses

Fresh garlic, garlic powder and garlic oil are used in foods and beverages as flavoring components. Garlic is used worldwide for this purpose.<sup>1,5</sup> In Ethiopia, garlic is used widely as a food additive. It is used in the preparation of barley flour (*ye gebs duqet*),<sup>6</sup> beans flour (*ye baqela duqet*),<sup>7</sup> herbed butter (*nitir qibe*),<sup>8</sup> green pepper paste (*tiquq qaria awaze*),<sup>9</sup> red pepper paste (*awaze*),<sup>10</sup> spiced oil (*ye tenetere zeit*),<sup>11</sup> and many other foods.

## Medicinal Uses

In folk medicine, garlic is used for the treatment of high blood pressure, atherosclerosis, colds, coughs, whooping cough, and bronchitis. It is also used gastrointestinal ailments (digestive disorders with blotting and convulsive pain), menstrual pain, diabetes, corns, warts, calluses, otitis, muscle pain, neuralgia, arthritis, and sciatica.<sup>3</sup>

A survey conducted in southern Ethiopia indicated that *netch shinkurt* (garlic) is used for the treatment of common cold, malaria, cough, lung TB, hypertension, wounds, sexually transmitted diseases, mental illnesses, kidney and liver diseases, asthma, and parasitic infections. Other less important complaints treated with garlic included diarrhea, throat diseases, abdominal colic, gastritis, eye diseases, toothache, diabetes, skin diseases, headache, typhus, swellings, back pain, and hemorrhoids. It has also been used as an

antidote for snake bites.<sup>12</sup>

Scientific studies have shown that garlic reduces cholesterol and triglyceride levels, while raising high-density lipoprotein (HDL) levels. Garlic has been shown to decrease platelet aggregation and clot formation in the blood. It has also been shown to reduce blood sugar levels. Various investigators have reported on the antibacterial, antifungal and anti-cancer activities of garlic. In the 1800s, physicians routinely prescribed garlic inhalation for the treatment of tuberculosis.<sup>1</sup>

### Dosage and Adverse Reactions

The average daily dose is 4 gm of fresh garlic, or one garlic clove one to two times daily, or 8 mg of the essential oil.<sup>1,3</sup>

In Ethiopia, it has been reported that the most commonly used dosage is 2 to 3 tablespoon of the crushed garlic daily for a duration of five to 10 days.<sup>12</sup>

When taken orally, garlic can cause dose-related side effects, such as bad breath, irritation of the mouth and gastrointestinal tract, heartburn, flatulence, nausea, vomiting, and diarrhea. It can also cause changes in the intestinal flora. High dietary garlic intake can cause increased bleeding time. Topical application of fresh garlic can cause dermatitis and eczema.<sup>5</sup>

### Summary and Comments

Garlic is one of the most important herbs used worldwide, both to flavor food and as a medicinal agent. It is perhaps one of the most studied herbs. Various studies have demonstrated its usefulness in fighting infections and reducing cholesterol. There is ample justification for the many uses that garlic finds in Ethiopian traditional medicine.

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***Anethum graveolens* L.**  
**(Family: Umbelliferae or Apiaceae)**

**Common Name (s):** Dill, Anethi fructus, Dilly, European dill

**Vernacular Name (s):** Ensilal, Kamun (A), Kamuni, Kamona (O),  
Ensilal, Silan (T)  
(Market seed samples under local names  
are mixtures of *Anethum foeniculum*, *A.  
graveolens* and *Cuminum cyminum* seeds.)

### **General Notes, History, and Legends**

The word “*anethum*” is derived in the same way as “*anethum*” in the name of the plant *Anethum foeniculum* (see monograph on *A. foeniculum* under *Foeniculum vulgare* on page 92). “*Graveolens*” is derived from the Latin “grave” which means “heavy” or “strong,” and from the Latin “*olens*” meaning to smell. Therefore, “*graveolens*” expresses the “strong smell” of the plant.<sup>1</sup> The common name “dill” is derived from the Old Norse (Norwegian) word “*dilla*” meaning “to lull,” which describes the reputed soothing effect of the herb when it was given to crying babies.<sup>2</sup>

Dill was cultivated by the Greeks and Romans in Palestine. It was an ingredient of love potions and aphrodisiacs.<sup>2</sup> Roman gladiators were served a strong dill tea to stimulate them. German brides carried dill to symbolize good fortune in their marriage.<sup>3</sup>

### **Botany and Geographic Distribution**

Dill is an annual herb that reaches a height of about 30 to 130 cm.<sup>1</sup> It has small feathery leaves and yellow flowers.<sup>2</sup> The plant has a strong smell, especially when it is crushed.<sup>1</sup> To the untrained eye, the difference between *A. graveolens* (dill) and *A. foeniculum* (fennel) may be confusing. Jansen<sup>1</sup> enumerates the following identifying characteristics of *A. graveolens*:

- ◆ All parts smell and taste bitter, with slight pungency.

- ◆ The fruits are lense-shaped and narrowly winged.
- ◆ In most cases the secondary rays of the umbel are longer than in *A. foeniculum*.

*A. graveolens* appears to be indigenous to the Mediterranean region and Southeast Asia, including Russia.<sup>1,2</sup> It is cultivated in subtropical and temperate areas of India, England, the United States, Scandinavia, and Norway. It grows in the wild often as a weed in Spain, Portugal, and Italy.<sup>2</sup>

In Ethiopia, dill grows at altitudes of about 1,500 to 2,000 m. It grows in the wild, less commonly than *A. foeniculum*. It is cultivated in all parts of the country on small scale. The fruits are sold in local markets.<sup>1</sup>

### **Chemical Constituents**

The fruit of dill contains essential oil (3% to 4%), fatty oil (15% to 20%), pectin (6%), and crude protein (18%). The main constituents of the essential oil are *d*-limonene (up to 70%) and *d*-carvone (about 30%). The essential oil composition varies with the geographical origin, the type of cultivar, and the maturity rate of the seeds. The leaves contain ascorbic acid (vitamin C).<sup>1</sup>

### **Culinary Uses**

Dill (the seed, the above ground parts and the oil) is used as a culinary spice, and has a Generally Regarded As Safe (GRAS) status in the United States. Dill oil is also a fragrant component in cosmetics, soaps, and perfumes.<sup>4</sup> The fruits and the green parts of the plant have a bitter and pungent taste, yet a pleasant aroma. The leaves are used in soups, salads, boiled potatoes, and sauces. The fruits are used to flavor picked cucumbers, onions, vinegar, pastries, sauces, and sauerkraut. In some countries, the fruits are used to flavor bread.<sup>1</sup> In France, the seeds are used extensively to flavor pastries and sauces, and in India they are used as an ingredient of curry powder.<sup>2</sup>

In Ethiopia, the dried fruits and flowers of dill are used to

flavor *wot*. The tender parts of the plant including the fruits are used to flavor *katikala*, a popular traditional alcoholic drink.<sup>1</sup>

### Medicinal Uses

Historically, dill seed has been used for flatulence, hemorrhoids, bronchial asthma, neuralgia, renal colic, dysurea, genital ulcers, and dysmenorrhea. Topically, it is used for mouth and throat inflammation. Dill seed is taken orally for loss of appetite, fever and colds, cough, bronchitis, infection, liver and gall bladder complaints, and as a digestive aid. The above-ground parts are used for gastrointestinal complaints, and kidney and urinary tract infections.<sup>4</sup>

Dill seed has antibacterial, antispasmodic, sedative and diuretic effects. An aqueous extract of dill, when administered intravenously to animals, has been shown to lower blood pressure, dilate blood vessels, slow heart rate, and stimulate respiration. Dill leaf is a rich source of beta-carotene, iron, and potassium.<sup>4</sup>

In Ethiopia, dill has similar medicinal uses as fennel.<sup>1</sup>

### Dosage and Adverse Reactions

The common oral dosage of the dried fruits is 1 to 4 gm three times daily. For the oil, the dosage is 0.05-2 ml three times daily. Alternatively, 100-300 mg (2-6 drops) of dill oil is taken daily.<sup>4</sup>

When used topically, dill can cause contact dermatitis.<sup>4</sup>

### Summary and Comments

Studies on the effectiveness of dill are controversial; there are no reliable studies to draw conclusion from.<sup>5</sup> However, it is a safe plant. Dill seed and dill seed oil may be effective when used for dyspepsia.<sup>4</sup>

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***Boswellia* spp.**  
**(Family: Burseraceae)**

**Common Name (s):** Frankincense, Olibanum

**Vernacular Name (s):** Etan zaf, Walia meker, Macher (A),  
Libanot (O), Angouah (T) for *B. papyrifera*  
Etan (A), Mirafur (S) for *B. rivae*  
Etan (A), Chewdar (S) for *B. microphylla*  
Borena etan (A), Dakara (O) for *B. neglecta*  
Etan (A), Tantani (O) for *B. pirottiae*

**General Notes , History, and Legends**

Olibanum refers to the oleogum resin exuded from the incisions in the bark of *Boswellia* species. The black kohl used by Egyptian women to paint their eyelids is obtained from the charred frankincense. *B. carteri* is referred to as Bible frankincense, and *B. serrata* is referred to as Indian frankincense.<sup>1</sup>

The importance of frankincense in Ethiopia can be appreciated by referring to Chapter II in this book. Furthermore, there are sources that allude to this importance. For example, *Atse* (King) Libne Dingel (1508-1540) is said to have offered the Ethiopian church a load of *etan* to solicit its support in his fight against the imminent Oromo invasion of the time.<sup>2</sup> His throne name Libne Dingel (Wenag Segged, before he ascended the throne) also signified the importance of *etan*. *Libn* or *sihen* is the Cééz equivalent of *etan*.<sup>3</sup> Therefore, the name Libne Dingel/Sihne Dingel translates into “Frankincense of Virgin (Mary ?).” Notice also the vernacular Oromo name *libanot* for *B. papyrifera*.

Marco Polo referred to frankincense as “white incense.” The Greek word *libanos* is derived from the Hebrew *libanah* or the Arabic *lubān*, which means “white.” The Somali word *luben* means “cream.” The Chinese term for frankincense is “milk perfume.” Other names that were used for frankincense were the Hebrew *shekhlelth* and the Ethiopic *sekhin* (cf. Ref 3).<sup>4</sup>

## Botany and Geographic Distribution

*Boswellia* species are trees, or shrubs with barks which peel off as parchments. The greenish inner part contains aromatic resin, and the wood produces milky latex.<sup>5</sup>

The plants are found in African countries like Ethiopia, Somalia and Egypt. They are also found in Arabia and India.<sup>6</sup> *B. carteri* is found in Somalia and parts of Saudi Arabia.<sup>7</sup>

In Ethiopia, six species *Boswellia* grow: *B. papyrifera* (Del.) Hochst., *B. rivae* Engl., *B. microphylla*, *B. ogadensis*, *B. neglecta*, and *B. piottae*. Of these, *B. papyrifera* is the most common species. *B. rivae* is also common.<sup>8</sup>

*B. papyrifera*, also referred to as *Tigray etan*, occurs in lowland areas of Gojam, Shewa, Gondar, Tigray, and Eritrea at elevations of up to 1800 m above sea level. It is commonly used as incense.<sup>8,9</sup> *B. rivae*, which is commonly referred to as "Ogaden Type", or Ogaden Etan is used as incense and perfumery.<sup>8,9</sup> It grows in Sidamo and Harerege at elevations of 250 to 800 m, and in Konso at up to 1050 m.<sup>9</sup> *B. neglecta* is found in southern parts of Ethiopia in Bale, Gemu Gofa, Harerege, and Sidamo. It also grows in neighboring Kenya, Somalia, Tanzania, and Uganda.<sup>8</sup> *B. piottae* is perhaps endemic to Ethiopia. It is found in the Tekezze, Abay and Gibe River valleys.<sup>5</sup>

## Chemical Constituents

Indian frankincense (Indian Olibanum, Salai Guggul) obtained from *B. serrata* contains boswellic acid and  $\alpha$ -boswellic acid.<sup>1</sup> The constituents from the gum of *B. carteri* and other related species include 3% to 8% volatile oils (pinene, dipentene, etc.), about 60% resins, 20% gum (polysaccharide portion), 6% to 8% bassorin, and a bitter principle.<sup>6</sup>

Several Ethiopian *Boswellia* species have been analyzed for their volatile oil constituents. The known volatile constituents of Ethiopian frankincense plant species are listed in Table 2.<sup>8</sup>

Table 2. Volatile Oil Constituents of Ethiopian *Boswellia* Species\*

Plant name	Vernacular name	Volatile oil constituents (percentage yields)
<i>B. neglecta</i>	Borena etan (A), dakara (O)	$\alpha$ -thugene, 26.4% $\alpha$ -pinene, 20.7% $\beta$ -pinene, 1.9% <i>p</i> -cymene, 4.5% Camphor, 2.8% 4-terpineol, 15.7%
<i>B. papyrifera</i>	Etan zaf; Walya meker (A)	$\alpha$ -pinene, 6.1% Camphene, 0.6% $\beta$ -pinene, 2.0% Myrcene, 1.7% Limonene, 4.8% 1-octanol, 5.9% Linalool, 3.6% Octyl acetate, 46.8% Geraniol, 1.1%
<i>B. rivae</i>	Etan (A); Mirafur (S)	$\alpha$ -pinene, 76.7% <i>p</i> -cymene, 9.8% $\alpha$ -campholene Aldehyde, 1.1% <i>trans</i> -verbenol, 2.4% $\alpha$ -santalene, 0.4%

Table 2. (Continued)\*

Plant name	Vernacular name	Volatile oil constituents (percentage yields)
<i>B. pirottae</i>	Etan (A); Tantani (O)	$\alpha$ -pinene, 74.3% Sabinene, 13.0% <i>p</i> -cymene, 1.8% <i>trans</i> -verbenol, 1.9%
<i>B. microphylla</i>	Etan (A); Chewdar (S)	$\alpha$ -pinene, 2.2% $\beta$ -pinene,,5.3% <i>p</i> -cymene,26.9% Linalool,1.8% Camphor, 2.8% Terpineol, 8.5% Citronellol, 1.6% Anethole, 1.6%

\*Compiled from Ref. 8.

## Culinary Uses

The resin oil and extracts of *B. serrata* (Indian Frankincense) are used in foods and beverages. They are also used in soaps and cosmetics. When used in prescribed amounts in foods, for example, in meat products at 0.001%, frankincense from the above source is considered safe. It is also approved for use in foods in the USA. Frankincense from *B. carteri* (Bible Frankincense) is used topically in hand creams.<sup>1</sup>

In Ethiopia, the use of frankincense in foods is limited. However, in food deficit situations, two *Boswellia* species have been reported to be edible. The gum from *B. papyrifera* has been used as a spice, while *B. rivae* (known by the local Oromiffa name as *qura*) has been reported to be edible. Both species are collected from the wild for this purpose.<sup>10</sup>

## Medicinal Uses

Indian frankincense is used orally for arthritis, as anti-inflammatory agent, and against ulcerative colitis. The constituents of the resin, boswellic acid and  $\alpha$ -boswellic acid possess anti-inflammatory properties. Historically, the plant has been used for rheumatism, syphilis, painful menstruation, pimples, sores, tumors, cancers, asthma, soar throat, abdominal pain, stomach complaints, nervous problems, as a stimulant, respiratory antiseptic, diuretic, and for stimulating menstrual flow. Bible frankincense is used for colic and flatulence.<sup>1</sup>

In Ethiopia, the resin obtained from a *Boswellia* species is mixed in water and taken as a cough remedy.<sup>11</sup> The combined powdered root of *B. papyrifera* and *B. pirottae* is a constituent of a multi-ingredient preparation, which is mixed with local beer and drunk as an aphrodisiac.<sup>12</sup> The resin from *B. papyrifera* is used as a febrifuge.<sup>13</sup>

## Dosage and Adverse Reactions

The dosage of Indian frankincense (gum resin) used in clinical trials for ulcerative colitis was 350 mg three times daily; for bronchial

asthma, it was 300 mg three times daily.<sup>1</sup> There are no dosages reported for other *Boswellia* species.

No adverse reactions have been reported for Indian frankincense,<sup>1</sup> or for other *Boswellia* species.

## Summary and Comments

Frankincense (*etan*) is an economically important plant product in Ethiopia. The use of *etan* as a culinary and medicinal agent is limited. However, its use as a fragrant product, especially in religious ceremonies makes it valuable. It is a commodity of commercial significance.

Medicinally, frankincense is considered obsolete. There is insufficient evidence for its effectiveness.<sup>1</sup>

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***Brassica nigra* L. var *abyssinica* A. Br.  
(Family: Cruciferae or Brassicaceae)**

**Common Name (s):** Black mustard

**Vernacular Name (s):** Senafitch (A and T);  
Midan Raffu, Raffu, Senafitcha (O)

**General Notes, History, and Legends**

There are a variety of mustards (different species) known by the general name "mustard," which include white or yellow mustard (*Sinapis alba* syn. *B. hirta*), brown mustard (*B. Juncea*), also known as Indian mustard, and black mustard (*B. nigra*).<sup>1,2</sup>

Mustard, like other spices, has a fascinating history. In 334 B.C., King Darius III of Persia is said to have sent Alexander the Great a bag of sesame seeds to signify the size of his army, to which in return Alexander the Great replied by sending a sack of mustard seeds to convey the might of his soldiers. In 812 A.D., Charlemagne issued a decree that mustard be planted on the imperial farms in central Europe. Mustard was an important seasoning during the Middle Ages. When Vasco de Gama set out on his voyage from Portugal, mustard was one of his provisions he took along. The great playwright Shakespeare mentions mustard in *Henry IV, Part 2*, Act II, Scene IV. The French humorist Anatole France writes, "*A tale without love is like beef without mustard: an insipid fish.*"<sup>2</sup>

**Botany and Geographic Distribution**

The mustard plants are annual or biennial herbs that grow to 3 to 9 ft high.<sup>1</sup> Brown mustard (*B. juncea*) seeds are dark and hard to distinguish from black mustard (*B. nigra*) by looking at the seeds. However, *B. nigra* can grow to 8 to 10 ft tall, while *B. juncea* is about half this size. In addition, black mustard is more pungent than brown mustard.<sup>3</sup>

Common mustards are cultivated worldwide.<sup>1</sup> *B. nigra* appears to be indigenous to southern Europe and the Mediterranean region,

while *B. juncea* is primarily native to northern Himalayas. *B. juncea* (Indian mustard, brown mustard) is cultivated on a large scale in India, and is extensively grown in parts of Africa and China.<sup>2</sup>

Both brown (Indian mustard) and black mustard (*senafitch*) grow in Ethiopia. The two species *B. nigra* (black mustard) and *B. juncea* (brown mustard) are two of the six cultivated species that are found in Ethiopia.<sup>4</sup> *B. nigra* is mainly grown in backyards, but can also be found in the field along with another species, *B. carinata* (Ethiopian mustard) known also as Ethiopian kale, 'gomen' for young plants and leaves, and 'gomen zer' for the oily seeds.<sup>5,6</sup>

### **Chemical Constituents**

Singrin is a glycoside found in black and brown mustards. When the powdered mustard seeds are mixed with water, the enzyme myrosin hydrolyzes singrin to the pungent principle allyl isothiocyanate. Ground mustard does not have pungent aroma, unless it is mixed with water. The volatile mustard oil can be obtained by steam distillation after expressing the fixed oil. The fixed oil portion does not contribute to the pungency of mustard. Allyl thiocyanate is a strong irritant and a blistering agent. It induces lacrimation. In fact, it is one of the most toxic essential oils. Derivatives of the mustard oil constituent allyl thiocyanate have formed the basis for toxic agents such as "mustard gases" and anti-neoplastic agents.<sup>1,7</sup>

### **Culinary Uses**

Mustard must be moistened for about ten minutes before use to release its pungent principle, which imparts the characteristic sharp, hot, and tangy flavor. The quality of the spice is lost gradually.<sup>2</sup> Black mustard is a culinary spice that finds use in condiment mixtures, foods, and beverages.<sup>7</sup> It is one of the most widely used spices in the Western world.<sup>1</sup> Despite the reputed toxicity of their allyl thiocyanate content, black mustard seeds are safe when used in prescribed amounts in foods. They have been granted GRAS status by the FDA in the USA.<sup>7</sup>

In Ethiopia, *senafitch* (*B. nigra*) is an important ingredient of *siljo*, a popular dish during Lent season.<sup>6</sup> It is also included in the

preparation of *azifa*.<sup>8</sup>

### **Medicinal Uses**

Black mustard seed has been used topically as a poultice for bronchial pneumonia, pleurisy, arthritis, lumbago, aching feet, rheumatism, and as a counter-irritant. It has also been used traditionally as an anti-emetic, diuretic, and appetite stimulant.<sup>7</sup>

In Ethiopia, *senafitch* (black mustard seed) has been used for complaints such as stomach ache, constipation, bloating, amoebic dysentery, and as an abortifacient. It has also been used for abscess dressing<sup>9</sup> and stomach complaints and wounds<sup>8</sup>. It has been reported to be used for indigestion and flatulence.<sup>10</sup>

### **Dosage and Adverse Reactions**

For topical use, 100 gm of ground black mustard is mixed with water into a paste, which is then packed in linen and applied to the affected area for 10 minutes (3 to 5 minutes for children over six years old). Treatment should not exceed two weeks. As a counter-irritant, black mustard oil is used in 0.5% to 5% concentrations three to four times daily.<sup>7</sup>

Ingestion of large amounts of black mustard seeds can cause vomiting, stomach pain, diarrhea, somnolence, cardiac failure, breathing difficulties, coma, and possibly death. Topical use for a period of 15 to 30 minutes or longer can cause severe burns and necrosis.<sup>7</sup>

### **Summary and Comments**

Mustard is an important culinary and medicinal plant. It finds use in Ethiopian foods such as "siljo" and "azifa". Its use in abscess dressing may stem from its counterirritant effect, which is a well-established property.<sup>11</sup> An irritant itself, mustard's use for GI complaints such as stomach ache and constipation is not well-founded, although it is used for similar purpose in other cultures.

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***Capsicum annum* L.; *C. frutescens* L.;  
hybrids of other *Capsicum* species  
(Family: Solanaceae)**

**Common Name (s):** Capsicum, Cayenne pepper, Red pepper, African chilies, Green pepper, Paprika, Tabasco pepper, Goat's pod, Grains of Paradise

**Vernacular Name (s):** Berbere, schriba, mitmita, qaria (A); afrindschi (Agew); filfil-ghedut (S); ademedha (Gambella)

**General Notes, History, and Legends**

The name *capsicum* is derived from the Latin *capsa*, meaning box or case, referring to the partially hollow box-like fruit.<sup>1,2</sup> The name may also be a Latinization of the Greek word *capsicon*, which is itself derived from *kapten* (to bite), referring to the pungency of the fruits.<sup>1</sup>

*Capsicum* peppers probably originated from Central and South America.<sup>1</sup> The plant was first described in the mid-1400s by a physician who accompanied Columbus to the West Indies.<sup>2</sup> Towards the end of the 15<sup>th</sup> century Columbus introduced *capsicum* fruits from the New World to Spain. It then spread to the whole world in the 16<sup>th</sup> century.<sup>1</sup> By 1650, the cultivation and use of *capsicum* peppers as a spice had spread through Europe, Asia and tropical Africa.<sup>3</sup> *Capsicum* has been cultivated in almost every society, and is among the most widely consumed spices in the world.<sup>2</sup>

**Botany and Geographic Distribution**

In general, *Capsicum* species are perennial, erect, 0.5 to 1.5 m high herbs, with strong brown taproot and many brownish side roots.<sup>1</sup> *Capsicum* peppers are different from white and black peppers obtained from *Piper nigrum*.<sup>2</sup> Because of long period of cultivation and hybridization, considerable variation exists among *Capsicum* species in their habit, size, color, shape, flavor, pungency, and even in taxonomic characteristics. The number of *Capsicum* species is not

exactly known, although there are five main cultivated species. *C. annum* is the most widely cultivated species and includes all the sweet peppers, as well as a large number of the pungent types. Its fruits vary in length from  $\frac{1}{2}$  in to 11 in, and the color from yellow to brown or purple to bright brick red.<sup>3</sup>

*Capsicum* occurs in all parts of the world. According to Jansen, *C. annum* is the species that occurs in Ethiopia. It is ubiquitous. Both the green and red fruits are harvested and used. The fruits are sold in almost every market, and the plant is cultivated in all parts of the country, with the main centers of cultivation being Ghion, Bako and Harar. *Capsicum* grows at altitudes of 1,000 to 2,000 m above sea level, or even 3,000 m as in the Semen Mountains. The typical areas of cultivation are at altitudes of 1,500 to 2,000 m.<sup>1</sup>

At higher altitudes, the fruits do not ripen well and are difficult to dry. According to a 1972 estimate, approximately 2.5% of Ethiopian arable land was cropped with *capsicum* every year.<sup>1</sup> Ethiopian Spice Extraction Company extracts a pigment from red pepper, which is used as a food coloring agent.<sup>4</sup>

## Chemical Constituents

*Capsicum* contains about 1.5% of an irritant oleoresin, with capsaicin being the major component of the latter. Capsaicin is chemically related to eugenol, an irritant substance also found in clove oil. Both are known to provide long-lasting analgesia. The pungency of the fruits is more pronounced in tropical climate than in temperate climates. The taste of capsaicin in water can be detected at concentrations as low as one part in 11 million.<sup>2</sup> The pigment principle in *capsicum* is the carotenoid capsanthin.<sup>1</sup> Because of its irritant constituents, *capsicum* is a main ingredient of defensive sprays, also referred to as pepper sprays. When sprayed into an attacker's eye, it causes temporary loss of vision and intense irritation, which last up to 30 minutes with no permanent damage. The effect is reversible.<sup>2,5</sup>

## Culinary Uses

*Capsicum* is perhaps the most popular and widely used spice

ingredient in foods in the world. It comes under various names, with different levels of pungency; paprika (Spanish pepper)-mild; cayenne pepper (red pepper)-moderate; Nepal pepper, chilli, pickled pepper, Tabasco pepper sauce, Chilipetin (bird pepper).<sup>1</sup>

*Capsicum (berbere, qaria)* is considered the ‘national spice’ of Ethiopia.<sup>1</sup> Various forms of capsicum are used as spices in a variety of foods, or sometimes consumed as vegetable. The following types of capsicum are common in Ethiopia:

“*Qaria*” is the green immature form of capsicum. It is eaten plain, as “stuffed *qaria*,” with onion, oil and salt being enclosed in the pod, or may be chopped up to be added to “*wot*” and other foods.<sup>1</sup>

“*Berbere*” refers to the red matured pungent fruits. It may also refer to a mixture of the red fruit and various other spices, which is commonly used in *wot* to give it pungency and palatable taste qualities.<sup>1</sup> “*Berbere*,” also referred to as hot pepper seasoning, comprises of as many as 11 spices in addition to chili peppers.<sup>6,7</sup> It is commonly used in the preparation of *doro wot* (chicken in hot sauce), *siga wot* (beef in hot sauce) and *kitfo* (spiced and buttered minced beef).<sup>7</sup>

“*Mitmita*” refers to the small extremely pungent fruits. The powdered “*mitmita*” is used by itself, or after mixing with other spices.<sup>1</sup>

## Medicinal Uses

When taken orally, capsicum has multiple traditional medicinal uses, such as for digestion, as an anti-flatulent, for colic, diarrhea, cramps, toothache, insufficient blood circulation, reducing cholesterol and clotting tendencies, sea sickness, alcoholism, malarial fever, yellow fever and other fevers, and for preventing arteriosclerosis and heart disease. Topically, it is used for various types of pain. It is also used as a counter-irritant to desensitize nerves and to create a feeling of warmth. In addition, it is used to relieve muscle spasm, as a gargle for laryngitis, and as a deterrent to thumb-sucking and nail biting.<sup>5</sup>

In conventional medicine, capsaicin (obtained from *C. annum*) is incorporated into a cream as a topical analgesic. Zostrix® (0.025%

to 0.075% capsaicin content) is such an FDA-approved over the counter product, which is used for temporary relief of muscle and joint pain associated with arthritis, bruises, and sprain. The medication may initially cause pain due to the release of a pain transmitter called substance *P* in the nerves. The high-potency product is used to treat diabetic neuropathy. After repeated application of the product, the substance is depleted thereby reducing pain sensation.<sup>2,5,8</sup>

In Ethiopia, capsicum pepper is mixed with liver of a rabid dog, and administered to a person bitten by the same dog.<sup>1</sup> Capsicum powder is slurried and drunk to ease stomach pain; it is also alleged to be antimicrobial when taken orally. It is dubbed *yabesha merfe* (injection of the *Habasha*) to connote its purported potency.<sup>9</sup>

### Dosage and Adverse Reactions

The common oral dosage is 30-120 gm of the fruit three times daily; the tincture, 0.3-1.0 ml; stronger capsicum tincture, 0.06-2 ml; oleoresin, 0.6-2 mg. Topically, capsaicin cream (over the counter product) is applied to affected areas three to four times daily. It can take up to three days to achieve full effect.<sup>5</sup>

If the fingers are used to apply capsicum, the hands must be washed with diluted vinegar. It is not washable (soluble) with water. Capsicum can be irritating to the eyes and mucous membranes. If inhaled, it can cause allergic alveolitis. When ingested orally, it can cause gastrointestinal irritation, sweating, flushing of the head and neck, lacrimation, and rhinorrhea. Excessive amounts of capsicum can cause gastroenteritis, and may affect the liver and kidneys. Breast-fed infants, whose mothers eat highly pepper-spiced foods, can experience dermatitis.<sup>5</sup>

### Summary and Comments

Capsicum is the most valuable spice in Ethiopia, as it is worldwide. Almost all Ethiopian dishes have capsicum peppers. Its medicinal use in Ethiopia to treat stomach pain may be related to its similar effect when used topically to ease pain. However, this is merely a speculation which may warrant research in the future.

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***Cinnamomum zeylanicum* Garc. Ex.BI.**  
**(Family: Lauraceae)**

**Common Name (s):** Cinnamon, Batavia cassia, Batavia cinnamon,  
Ceylon cinnamon, Padang-cassia,  
Panang-cinnamon, Saigon cassia, Saigon  
cinnamon

**Vernacular Name (s):** Qarafa (A); Carafu (O), Crefte (T)

**General Notes, History, and Legends**

In Great Britain, the name “cinnamon” applies *C. zeylanicum* (*C. Verum*) and “cassia” to *C. cassia*. In the United States, the term cinnamon refers to both *C. zeylanicum* and *C. cassia* (*C. aromaticum*).<sup>1</sup> Therefore, what is available in American markets as cinnamon is actually either cassia, or cassia/cinnamon mixture.<sup>2</sup> Cinnamon and cassia are two of the oldest spices known. In the popular literature, when the term cinnamon is used it may refer to either species, unless qualification is made.<sup>1</sup>

In the Bible, it is written that God instructed Moses to prepare an oil to anoint the tabernacle of Israelites. The oil was to contain cinnamon and cassia as two of the ingredients:

*“Take thou unto principal spices, of pure myrrh five hundred shekels, and of sweet cinnamon half so much, even two hundred and fifty shekels, and sweet calamus two hundred and fifty shekels, And of cassia five hundred shekels, and the shekel of the sanctuary, and of oil olive an hin: And though shalt make it an oil of holy ointment, an ointment compound after the art of the apothecary: it shall be an holy anointing oil.”* (Exodus 30:23-25).

In the Orient, cinnamon, “the sweet wood,” has been used for many centuries in temples to neutralize the offensive smell of obnoxious

offerings. In 66 A.D., a grieving emperor Nero is said to have burnt a huge amount of cinnamon at his wife's funeral in Rome. In the 9<sup>th</sup> century A.D., cinnamon along with pepper and cloves was used to season fish in a Swiss monastery. When the Portuguese took over Ceylon (now Sri Lanka), they collected large amounts of cinnamon bark as payment of tribute from the local rulers.<sup>1</sup>

### **Botany and Geographic Distribution**

*C. zeylanicum* is an evergreen tree of the laurel family reaching a height of up to 30 to 40 ft. The dried bark is the "true" cinnamon that is commercially used as a spice. The leaves measure up to 5 to 7 ft long, and are dark glossy green at the top surface, and lighter underneath. The flowers are small and yellow in color. Cassia is a taller tree, with thicker bark, larger leaves, and smaller flowers and fruits than cinnamon.<sup>1</sup>

*C. zeylanicum*, also known as "true cinnamon," is native to Sri Lanka (formerly Ceylon). The bark, which is referred to as cinnamon, has a light brown color. *C. cassia* grows in China, Indonesia and other South East Asian countries. It produces a darker, reddish-brown bark, which has a stronger and more pungent taste.<sup>2</sup>

Although commonly used, cinnamon is not grown in Ethiopia. It appears that the spice is imported into the country.

### **Chemical Constituents**

The major constituent of the essential oil of cinnamon is cinnamaldehyde (65% to 80%), and lesser amounts of other phenols and terpenes, including eugenol, *trans*-cinnamic acid hydroxycinnamaldehyde, *O*-methoxycinnamaldehyde, cinnamyl alcohol and its acetate derivative, limonene,  $\alpha$ -terpineol, tannins, mucilage, oligomeric procyanidins, and trace amounts of coumarin.<sup>3</sup>

### **Culinary Uses**

Cinnamon is used in foods and beverages.<sup>4</sup> It has been used as a spice and taste enhancer for centuries.<sup>3</sup> Both cinnamon and cassia are commonly used in bakery products, such as cakes, breads, buns,

cookies, and pies. Cinnamon sticks are also used to flavor stewed prunes, spices peaches, and beverages. Mexicans use it in hot chocolates.<sup>1</sup> Although a clear distinction is not made, in the United States both cassia and cinnamon have a GRAS status in food systems at pre-determined levels.<sup>4</sup>

In Ethiopia, cinnamon sticks have been used to flavor tea. Cinnamon powder is used to as an ingredient of *berbere* (red pepper spice mix)<sup>5</sup> and *awaze* (red pepper paste),<sup>6</sup> and to spice foods, such as *mitin shiro* (spiced, hot, powdered peas),<sup>7</sup> *yeminshet abish dabo* (bread made with spiced minced beef sauce),<sup>8</sup> and *ginfilfil* (*injera* in sauce mixed over low heat).<sup>9</sup>

### Medicinal Uses

People use cassia as antiflatulent, antiemetic, antidiarrheal, antimicrobial, and for treating common cold and loss of appetite. Topically, it is used in suntan lotions, nasal sprays, mouthwashes, gargles, toothpaste, and as a counter-irritant in liniments. In Chinese medicine, the bark is used to treat impotence, diarrhea, enuresis, rheumatic conditions, testicle hernia, menopause syndrome, amenorrhea, as immune stabilizer and abortifacient.<sup>4</sup>

Cinnamon bark is used for most of the same complaints that cassia is used for. Historically, it has been used for gastrointestinal upset and dysmenorrhea.. Topically, it is used as an ingredient of a multi-component preparation to treat premature ejaculation.<sup>4</sup>

Aqueous and ethereal extracts of *C. cassia* have shown antidiarrheal effect when tested in mice.<sup>3</sup> The volatile oil in cinnamon is responsible for the antiflatulent, antispasmodic, and appetite stimulant effects. The constituent cinnamaldehyde has antipyretic, antibacterial, and antifungal activity. The antidiarrheal effect is attributable to the astringent effect of tannins.<sup>4</sup>

In one controlled clinical trial, cinnamon was tested as an ingredient of a multi-component cream (SS Cream) for its effectiveness in treating pre-mature ejaculation in men. The cream consisted of a mixture of cinnamon bark, Panax ginseng root, Angelica root, *Cistanches deserticola*, *Zanthoxyl* species, Torlidis seed, clove

flower, Asiari root, and toad venom. In this clinical trial, the SS cream was applied to the glans of the penis 1 hour before intercourse followed by washing off immediately before intercourse. The ejaculatory latency period was significantly improved when compared to placebo. This preparation containing cinnamon is thought to work by increasing the penile vibratory threshold and reducing the amplitude of penile somatosensory evoked potentials.<sup>4</sup> Whether this activity is due to the cinnamon ingredient, the other ingredients, or a combination of both is not clear. Considering the use of cinnamon in treating impotence by the Chinese, one may speculate that cinnamon may contribute to the observed effect in the study.

In Ethiopia, although *qarafa* has been used by in teas by people to treat cold symptoms, it appears that there are no medicinal uses reported in the literature.

### Dosage and Adverse Reactions

The usual oral dosage of cinnamon is one cup of the tea three times daily. The tea is prepared by steeping 0.5-1.0 gm of the bark in 150 ml boiling water for 5 to 10 minutes, followed by straining. Alternatively, 0.51 ml of the liquid extract (1:1 in 70% alcohol) can be taken three times daily. The maximum dose for the bark is 2-4 gm daily.<sup>4</sup>

Oral use of cinnamon does not cause adverse reactions. However, topical use of the oil can cause skin irritation. In sensitive individuals, concentrations exceeding 0.01% can cause allergic dermatitis.<sup>4</sup>

### Summary and Comments

Cinnamon has been used as a spice, fragrance, and folk medicine for centuries. It has played a significant role in human history. Although the plant does not appear to be cultivated in Ethiopia, it is widely used in food systems, and rarely as a medicinal agent.

Cinnamon is possibly effective as an antiflatulent, antispasmodic, and appetite stimulant. As a component of the multi-

ingredient preparation SS Cream, it may also be effective on a short-term basis when used topically to treat premature ejaculation in males.<sup>4</sup>

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***Citrus limon* L. syn. *C. medica* var. *Lemon* L., *C. lemonum* Risso  
(Family: Rutaceae)  
*C. aurantifolia* (Christm.) Swingle  
(Family: Rutaceae)**

**Common Name (s):** Lemon, Limon for *C. limon*; Lime, Limetta,  
Adam's apple for *C. aurantifolia*

**Vernacular Name (s):** Lomi; Lomit (In most local languages)

**General Notes, History, and Legends**

The vernacular name *lomi* may refer to either species. In the literature on Ethiopian medicinal plants, despite the same vernacular name used, a distinction is made when scientific names are used to designate the two closely related *Citrus* species.

The history of lemon (*C. limon*) is rather confusing, because of its similarity with "citron," a closely related species. However, lemon is thought to have been depicted in Roman artwork in the 1<sup>st</sup> century A.D. The fruit may have been first grown in Europe in the 2<sup>nd</sup> century A.D. English ships were required by law to carry lemons on board, so that sailors would consume them to prevent outbreaks of scurvy, a debilitating disease resulting from vitamin deficiency. The ships were nicknamed "limeys." In California, the United States, lemon industry took off tremendously after the famous Gold Rush of 1849.<sup>1</sup>

At traditional dancing festivities in the countryside, in Wello in particular, girls would hand *C. limon* (lomi) fruits to boys as a sign of courtship. *Lomi* is carried in the pocket for its fragrance.<sup>2</sup>

**Botany and Geographic Distribution**

The lemon tree (*C. limon*) is an evergreen that grows to over 6 m tall. The leaves are toothed and light green in color. The fruit is small, green to yellow in color, and oval in shape. *C. limon* originated in southeast, probably in India and southern China Asia. The plant is cultivated in the Mediterranean region and in subtropical climates.<sup>1</sup>

*C. aurantifolia* is a thorny, evergreen tree that grows to a height of up to 2.5 m. The flowers are small, white and fragrant. The fruit is one-half size of lemon. It has a smoother and thinner peel. The fruit is sweetish in taste and greenish-yellow in color. The plant is indigenous to southern Asia. It is cultivated in the West Indies and other countries.<sup>3</sup>

*C. aurantifolia* has been grown in Ethiopia for a long time. Of the citrus fruits, it is the most widely cultivated. It is sometimes found naturalized.<sup>4</sup>

### Chemical Constituents

Generally, citrus fruits contain sugars, polysaccharides, organic acids, lipids, carotenoids (responsible for the color), vitamins, minerals, flavonoids, limonoids (impart bitterness), and volatile oil constituents.<sup>1</sup>

*C. limon* contains potassium, calcium, and vitamins A, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub> and C. Other constituents include volatile oils (2.5% of the peel), limonene, α-terpinene, α-pinene, citral, coumarins, mucilage, pectins and flavonoids (mostly in the pith and peel).<sup>1</sup> Lemon oil (the essential oil component) is extracted from the skin.<sup>3</sup>

*C. aurantifolium* contains volatile oil (citral, {+}-limonene, pinenes, alkanes, and alkanals). It also contains furocoumarins, flavonoids, citric acid, and vitamin C.

### Culinary Uses

Lemon is used as food and a flavoring agent.<sup>5</sup> It has been used in food preparation and the agricultural industry to gel and stabilize foods. It is also an important source of vitamin C.<sup>1</sup>

Known by the vernacular name *lomi*, both *C. limon* and *C. aurantifolia* are edible in Ethiopia.<sup>2,6</sup> The juice is directly sucked from the fresh fruits.<sup>7</sup> Lemon juice is used in the preparation of various Ethiopian foods, such as dried fish (*yasa quanta*),<sup>8</sup> boiled beets (*yeqey sir qiqil*),<sup>9</sup> fresh tomatoes and green pepper (*teematim begaria*),<sup>10</sup> chicken pea patse (*bit' echa*),<sup>11</sup> spiced chicken pea bread (*yeshimbira kitfo*), and fresh chopped tomatoes blended in *injera* and spices

(*yetimati fitfit*).<sup>12</sup> It is also used in cleaning meat.<sup>7</sup>

## Medicinal Uses

Lemon is used as a source of vitamin C in the treatment of scurvy, low resistance, and colds. It is also used as anti-inflammatory, diuretic, and to improve vascular permeability.<sup>5</sup> Lemon juice has long been used as a diuretic, diaphoretic, astringent, tonic, lotion, and gargle.<sup>1</sup> *C. aurantifolium* is used as a refrigerant, antiscorbutic, and for scurvy.<sup>3</sup>

Vitamin C, a constituent of lemon, is necessary to boost the body's resistance to infection and to improve the healing of wounds. Despite its acidity, once ingested lemon has an alkaline effect in the body, thus helping alleviate rheumatism, arthritis, and gout. Lemon's antimicrobial activity has been reported. The pectin content of lemon is hydrophilic, and hence useful to treat vomiting and diarrhea, by thickening gastric contents, and regulating transit. It also lowers blood cholesterol levels. The bioflavonoid constituent strengthens the inner linings of blood vessels, thus helping in the management of varicose veins. Animal and human studies have also shown lemon to be beneficial in decreasing cancer rates. Lemon has corrosive effect on tooth enamel.<sup>1</sup>

In Ethiopia, *C. aurantifolia* has been used in the treatment of skin problems.<sup>7</sup> The fruit has been used as an ingredient of a multi-component traditional prescription for treating tremor.<sup>13</sup> A decoction of the leaves is mixed with milk and drunk as a cough remedy.<sup>14</sup> Various parts of the plant are used in compounding multi-plant remedies for insanity,<sup>15</sup> "tila wegi,"<sup>16</sup> invoking spirit (*meeksife aganint*),<sup>17</sup> eye bruise,<sup>18</sup> rectal prolapse,<sup>19</sup> scabies,<sup>20</sup> epidemic,<sup>21</sup> wound,<sup>22</sup> rheumatic pain,<sup>23</sup> and as intelligence booster in children.<sup>24</sup> The combined, dried and powdered seedlings of *C. limon*, leaves of *Chenopodium ambrosoides* ("amedmado") and *Crustoe lichens* are mixed with butter and applied to the scalp to treat hair loss due to leishmaniasis (*lashign*).<sup>25</sup> The juice of *C. limon* is applied to the eyes to treat eye problems. It is also used for tonsilitis in children. The juice is mixed with barley and sulfur and used for hyperpigmentation of the

skin (*madiat*). *C. limon* is used for cleaning the teeth, as a vehicle for compounding traditional prescriptions, and as antidote to toxins.<sup>26</sup>

### Dosage and Adverse Reactions

There is no typical dose for either lemon or lime. However, lemon is taken as an oil, tincture, or fresh fruit, and lime is taken as a liquid extract, or as a fresh fruit.<sup>5</sup>

No significant adverse reactions have been reported for lemon and lime fruits. Topical use of lime oil, however, has been associated with hypersensitivity. Expressed lime oil and lime peel can cause phototoxic reactions.<sup>5</sup>

### Summary and Comments

Both lemon (*C. limon*) and lime (*C. aurantifolia*) are used as flavoring agents. They are sources of vitamin C. Historically, they have been used to prevent scurvy, a disease caused by vitamin C deficiency.

In Ethiopia, *lomi* is used to spice a number of traditional dishes, and to give them palatability. In traditional medicine, it is used in many preparations as a vehicle, or medicinal agent. There are no scientific data to support the traditional medicinal uses of lemon or lime.<sup>5</sup>

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***Commiphora* spp.**  
**(Family: Burseraceae)**

**Common Name (s):** Myrrh (for *Commiphora myrrha* or *C. molmol*)  
 Bal bol, bala, heerabol, gum myrrh, mo yeo,  
*myrrha* (For most *Commiphora* spp.)  
 "False myrrh," Indian bdellium (for *C. mukul*)  
*Opopanax* (for *C. guidotti*, etc.)

**Vernacular Name (s):** Kerbe (A), Dhdin (S) for *C. myrrha*  
 Habkhadi (S) for *C. guidotti*  
 Hagarsu (O) for *C. spahecorpa*  
 Dunkhal (S) for *C. enlageriana*  
 Ankua for *C. abyssinica*

### General Notes, History, and Legends

The common name myrrh refers to the oleo-gum resin exudate from incisions in the bark of *Commiphora* species, including *C. molmol* Engl., *C. abyssinica* Engl. and *C. myrrha* (Ness) Engl. It refers neither to the plants nor plant parts. It is not clear, however, to what extent "true myrrh" is adulterated with other resins in commerce to yield inferior quality. The name "Opopanax" is derived from *Opopanax chironium*, its original source. The main source of Opopanax is the so-called *C. erythrea*-*C. kataf* complex, but the resin is also obtained from *C. guidotti* and *C. holtziana*.<sup>1</sup>

Myrrh has been used in embalming and as an incense. In manufacturing, myrrh oil is used as a fragrance and fixative in cosmetics.<sup>2</sup>

Myrrh is also known as a scriptural substance. It is mentioned in the Bible many times. Myrrh was one of the gifts given to baby Jesus by the Three Wise Men upon his birth (Matt 2:11). Ironically, myrrh was mixed with wine and offered to Jesus to supposedly ease his pain prior to his crucifixion at Golgotha: however, he did not drink it (Mk 15:23). It is also mentioned that Nicodemus brought a mixture of aloes and myrrh to wrap Christ's body for burial (John 19:39-40;

Mk 15:23). Myrrh was also widely used in religious ceremonies of ancient Egyptians.<sup>3</sup>

### Botany and Geographic Distribution

The *Commiphora* species that yield myrrh are trees that grow to a height of 30 ft.<sup>3</sup> However, in general, *Commiphora* species are small trees or shrubs with short, thorny branches.<sup>1</sup> Botanists call the *Commiphora* taxon "an impossible genus," because of the difficulties encountered in characterizing the various species as distinct taxa. For most part of the year, they do not bear leaves. The flowers are tiny and appear when the plants are leafless. Furthermore, the leaves and fruits appear at different times. If collected, the specimens are difficult to handle for identification. The number of *Commiphora* species is estimated to be between 150 and 200.<sup>4</sup>

A pale yellow viscous liquid exudes from natural cracks in the bark, or from fissures cut intentionally to harvest myrrh. The exudate hardens into yellow-brown tears that are the basis of myrrh resin.<sup>3</sup>

*Commiphora* species are native to Africa, and are found in the Red Sea region.<sup>3</sup> *C. myrrha* is found in some African and Asian countries.<sup>5</sup>

There are about 50 *Commiphora* species found in Ethiopia. The following are some of the important species growing in Ethiopia, which are sources of myrrh.

- |                                    |  |
|------------------------------------|--|
| <i>C. myrrha</i> (Nees). Engl.     | <i>C. kua</i> (R.Br. Ex. Royale) Vollsen |
| <i>C. africana</i> (A.Rich.) Engl. | <i>C. quadrcinta</i> Schweinf            |
| <i>C. gileadensis</i> (L.) C. Chr. | <i>C. schimperi</i> (Berg.). Engl.       |
| <i>C. abyssinica</i> (Berg.) Engl. | <i>C. truncata</i> Engl.                 |
| <i>C. hodani</i> Sprague           | <i>C. erythrea</i> (Ehrneb.) Engl.       |

*C. gileadensis* is found in Eritrea and Harerghe below 750 m above sea level. The other species listed above occur in Eritrea, Tigrai, Gojam, Gondar, Wello, Shewa, Arsi, Sidamo, Harerghe, Bale, and Gamu Gofa at elevations of up to 2,000 m above sea level. They are also common in lowland areas below 100 m.<sup>6</sup> The genus, along with

*Boswellia*, is a characteristic taxon of the Somali-Masai floristic region. This Northeast African vegetation region encompasses a part of Ethiopia, known for its floristic endemism.<sup>7</sup>

### Chemical Constituents

Myrrh is an oleo-gum resin that contains 1.5% to 17% of a volatile oil mainly composed of heerabolene, limonene, dipentene and other additional fragrant constituents. About 20% of the resin consists of commiphoric acids, and about 60% is a gum that yields various sugars upon hydrolysis. A sesquiterpene (+)-T-cadinol has been isolated from *C. guidotti*.<sup>3</sup>

The volatile oil constituents of various Ethiopian *Commiphora* species have been investigated, and is summarized in Table 3.<sup>8</sup>

Investigators in the United States recently isolated four furanosesquiterpenes, inclusive of two new compounds from the exudate of *C. myrrha* collected in the People's Republic of China. One of the new compounds, *rel*-1S, 2S-furanogermacr-10 (15)-en-6-one exhibited activity against a breast cancer cell-line when tested in a standard clonogenic assay.<sup>5</sup> In recognition of their paper, the authors were awarded "The Newsmaker 2002" by the American Chemical Society, which co-publishes the *Journal of Natural Products*.<sup>9</sup>

Interestingly enough, Professor Ermias Dagne and co-workers isolated a series of lignans, enlargerins A, B, C, and D from the resin of *C. enlargeriana*, collected in Gode, Ethiopia.<sup>10</sup> These compounds bear important structural similarity to podophyllotoxins. In the past, the latter on structural modification have yielded such clinically significant anticancer agents as etoposide, teniposide, and etophos. As the authors of the Ethiopian study indicated, it would be interesting to investigate the activity of enlargerins A-D in a battery of cancer cell lines, or by using other feasible anti-cancer screening methods.

### Culinary Uses

Myrrh is sometimes used to flavor beverages and foods.<sup>3</sup> It is approved for use in food in the USA. Myrrh is safe when consumed in amounts commonly found in foods.<sup>2</sup>

Table 3. Volatile oil constituents of some Ethiopian *Commiphora* species

Plant name	Place of collection	Volatile oil constituents (% yield)
<i>C. myrrha</i>	Gode	$\beta$ -pinene, 0.4% $\gamma$ -elemene, 3.7% $\beta$ -bourbonene, 2.0% $\beta$ -elemene, 10.5% Germacrene D, 2.6% Furanodiene, 8.8% Isofuranogermacrene, 6.1% Germacrene B, 6.6% Furanoeudesman-1,4-diene, 3.0% Furanoeudesman-,1,3-diene, 41.0% Lindestrene, 10.7% 2-methoxyfuranodiene, 1.5%
<i>C. guidotti</i>	Gode	Ocimene, 27.8% Santalol, 24.4% Bergamotene, 4.1% Germacrene D, 5.7% <i>Cis</i> - $\alpha$ -bisabolene, 8.1%
<i>C. sphaerocarpa</i>	Sof Omar	$\alpha$ -pinene, 13.7% Camphene, 1.7% $\beta$ -pinene, 2.8% Myrcene, 3.2% <i>p</i> -cymene, 2.6% $\gamma$ -terpinene, 2.3% 4-terpineol, 2.4% $\alpha$ -copoene, 6.5% $\alpha$ -gurjunene, 4.1% $\alpha$ -cadinol, 3.1% Curzerenone, 5.3%

In Ethiopia, the use of *Commiphora* plants in foods is limited. In a study conducted on wild edible plants used in Ethiopia, it was found that three *Commiphora* species were used as famine foods. The fruits, leaves and roots (pith) of *C. abyssinica*, the fruits of *C. bovianini*, and the fruits and seeds of *C. ancistrophora* are used as edible food plants.<sup>11</sup> The fruits of *C. enlargeriana* are sold as edible foods during the Ethiopian rainy season.<sup>10</sup>

### Medicinal Uses

Myrrh has been reported to have mild astringent properties. Therefore it is used as an astringent in mouthwashes.<sup>3</sup> Topically, myrrh resin has been used for mild inflammation of the oral and pharyngeal mucosa, aphthous ulcers, gingivitis, and chapped lips. In folk medicine, the topical use extends to include for the treatment of hemorrhoids, bedsores, wounds, abrasions, furnuculosis, bad breath, and loose teeth. Internally, it has been used for indigestion, ulcers, colds, cough, asthma, bronchial congestion, arthritic pain, cancer, leprosy, and syphilis. It has also been used as a stimulant, antispasmodic, and to increase menstrual flow.<sup>2</sup> Myrrh has also been shown to stimulate peristalsis by its action on muscle tissue. In vitro, it has been shown to exert antimicrobial effect.<sup>3</sup> The volatile oil and mucilage constituents of myrrh have antimicrobial, deodorizing, anti-inflammatory, and antitumor properties. In experimental animals, myrrh resin exhibits antipyretic, hypoglycemic, and anti-gastric ulcer effects. Myrrh also stimulates uterine tone and promotes uterine blood flow.<sup>2</sup>

In Ethiopia, various *Commiphora* species are used medicinally. The flowers and roots of *C. africana* are used to treat elephantiasis. The leaves from an unidentified *Commiphora* species are used for what local herbalists call “*akoshita*.<sup>12</sup> The resins from *C. hodai* and *C. crenulata* are used for placenta expulsion and as a disinfectant, respectively.<sup>13</sup> *C. erythrea* has been used for the treatment of wounds.<sup>14</sup> A resin from a *Commiphora* species is mixed with other ingredients and made into a pellet, popularly known in Ethiopia as “*altet*,” which is sniffed to alleviate migraine symptoms.<sup>15</sup> In Ethiopia, when myrrh

oil in combination with other volatile oils was used as a mouthwash by HIV/AIDS patients with mouth thrush, it was reported there was a significant improvement in mouth soreness, and the patients were able to eat better.<sup>16</sup>

### Dosage and Adverse Reactions

The undiluted tincture of myrrh is applied two or three times daily for mild mouth and throat irritation. It is commonly used as a rinse or gargle, with 5 to 10 drops of the tincture in a glass of water.<sup>2</sup> An infusion is made with one teaspoon of powdered myrrh per cup of water, and drunk once or twice a day. Alternatively, 657 mg myrrh enclosed in a capsule can be taken two to three times a day.<sup>17</sup>

Myrrh can cause dermatitis. Intake of large amounts (greater than 2 to 4 gm) can cause kidney irritation, heart problems, and diarrhea.<sup>2</sup>

### Summary and Comments

Myrrh is an oleogum resin obtained from *Commiphora* species. It is a fragrant substance that has been used in religious ceremonies since ancient times. Although there is no evidence for its effectiveness as a medicinal agent in other conditions, it has been found to be effective as a mouthwash for treating inflammation.<sup>2</sup>

Ethiopian vegetation is rich in *Commiphora* plants, which are distributed in different parts of the country. A few of the species are used as sources of myrrh (*kerbe*). The plants have limited use in foods. They are widely used as a fragrance, especially in religious ceremonies. Certain *Commiphora* species are also used for medicinal purposes. The use of myrrh for treating wounds may stem from the reported astringent and anti-microbial properties.

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***Coriandrum sativum* L.**  
**(Family: Apiaceae or Umbelliferae)**

**Common Name (s):** Coriander, koriander, coriandri fructus, cilantro, Chinese parsley

**Vernacular Name (s):** Dimbelal (A); debao, shucar (O); tsagha, zagada (T)

**General Notes, History, and Legends**

“*Coriandrum*” is derived from the Greek *koriaron* which means bedbug, a depiction of the bedbug-like smell of the unripe fruits. “*Sativum*” is derived form the Latin word *serere*, which means “sown, planted, or cultivated.”

Coriander is the oldest spice known.<sup>1</sup> As can be inferred from the Bible, the Egyptians and Israelites knew coriander even before the time of Exodus:

“And the house of Israel called the name thereof Manna: and it was like coriander seed, white : and the taste of it was like wafers made with honey.” (Exodus 16:31)

Coriander was known in Egypt as both a culinary and medicinal plant as early as 1550 B.C. Hippocrates (440 B.C.) recommended it as a medicinal agent. In A.D. 812, Charlemagne ordered that coriander be grown on the imperial farms in central Europe.<sup>2</sup>

**Botany and Geographic Distribution**

Coriander is a green, shiny and annual herb. It grows to a height of 2 to 3 ft, with much branched stem and finely divided leaves.<sup>2</sup> The leaves vary in shape and size.<sup>1</sup> The flowers are small and white, or pinkish in color.<sup>2</sup> The fruits are about 2.5 to 4.5 mm in diameter. Based on the fruit diameter, varieties have been described, but Ethiopian coriander appears to be uniform in size.<sup>1</sup>

Coriander may be native to the Mediterranean region. It is

cultivated in Argentina, Brazil, Burma, China, Egypt, Ethiopia, France, Great Britain, India, Italy, Lybia, Morocco, the Netherlands, Paraguay, Peru, Poland, Rumania, Somalia, Spain, USA, former USSR, and the USA.<sup>1</sup>

In Ethiopia, coriander is widely sold in local markets. It has been cultivated in Eritrea, Harerghe, Shewa, Keffa, Wollega, and Begemdir. It was recorded that in the year 1880, 10% of the whole local market trade of coriander originated in Bonga, Keffa. The seed is sown at the beginning of the rainy season.<sup>1</sup>

### Chemical Constituents

The fruits of coriander contain fatty acids, such as palmitic, petroselinic, oleic, and linoleic acids. It also contains a volatile oil (0.2% to 0.84%).<sup>1</sup> The volatile oil is responsible for the aroma and taste. The chief constituent of the volatile oil is linalool (60% to 70%).<sup>3</sup>

### Culinary Uses

Known by the Spanish name *culantro or cilantro*, coriander is a favorite spice in several Latin American countries. It has a distinctive, warm, fragrant odor, and a pleasant taste. The whole seed is used as a pickling spice, and the ground form is used as an ingredient of curry powder and spice mixtures. It is also used to flavor pastries, cookies, buns, sausages, and frankfurters.<sup>2</sup> Coriander is used as a fragrant in cosmetics and soaps, and for flavoring tobacco.<sup>3</sup> Young coriander plants are used to season chutneys, sauces, curries, and soups, while the stems are sometimes used as a spice.<sup>2</sup>

In Ethiopia, coriander fruits are used in the preparation of the popular pepper powder, *berbere*, while the ground fruits are used to flavor *wot*, *injera*, cakes, and bread. In Keffa, the ground fruits are mixed with chopped green chilies, added to cheese, and eaten as *wot*, locally known as "diko."<sup>1</sup> It is also used in the preparation of what is locally known as "hulbet merekh" (tripe and tongue from lamb or beef cooked in fenugreek)<sup>4</sup> and emmer wheat bread (*ye aja dabbo*).<sup>5</sup>

## Medicinal Uses

Coriander is used as a flavoring agent in pharmaceutical preparations. Orally, it is used for dyspepsia, diarrhea, as a stomach function stimulant, spasmolytic, antiflatulent, bactericide, and fungicide. In folk medicine, it has also been used for worms, rheumatism, and joint pain. In China, people use coriander fruits for treating measles, dysentery, hemorrhoids, and toothaches, while the whole plant is used for stomachache, nausea, measles, and painful hernia.<sup>3</sup> The fresh ground fruits are applied topically to treat ulcers. In India, a decoction of coriander is a common remedy for biliousness.<sup>1</sup>

In Ethiopia, the fruits of coriander are boiled in water and drunk to treat stomachache.<sup>1</sup> The leaves are chewed to treat stomach ache.<sup>6</sup>

## Dosage and Adverse Reactions

The typical oral dose is 3 gm of dried fruits or seeds daily. Alternatively, one cup of tea can be taken three times daily between meals. The tea is prepared by steeping 1 gm of the crushed seeds or fruits in 150 ml of boiling water for 5 to 10 minutes. The usual dose of the tincture is 10 to 20 drops after meals.<sup>3</sup>

Powdered coriander and the oil can cause allergic reactions, photosensitivity, and contact dermatitis.<sup>3</sup>

## Summary and Comments

Coriander is widely used as a flavoring and medicinal agent, including in Ethiopia. It has received an enormous amount of research for its medicinal potential. It has been found to be effective in stomach upset. The oil has been shown to be effective against certain fungi and bacteria.<sup>7</sup>

The use of coriander for stomachache and colic in Ethiopia is supported by scientific reports.

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***Cuminum cyminum* L. Syn: *C. odorum* Salis  
(Family: Apiaceae or Umbelliferae)**

**Common Name (s):** Cumin; cummin

**Vernacular Name (s):** Ensilal, kamun (A); kamun, kamuna,  
kamun-bahari, hawaja (O); kemano (T)

**General Notes, History, and Legends**

Cumin was known to ancient civilizations. It has been recorded in Ebers Papyrus (1550 B.C.) as a medicinal plant. It is also referred to in the Bible (Isaiah 28:27 and Matt 23:23). In the 1<sup>st</sup> century, Pliny mentioned cumin to be the best appetizer of all the condiments. During the Middle Ages, cumin was believed to keep lovers from straying from home. In 716 A.D., it was used in monasteries in Normandy. Around 1419, the English crown collected taxes from the importation of cumin. Cumin is mentioned in the herbals of the 16<sup>th</sup> and 17<sup>th</sup> centuries.<sup>1</sup>

**Botany and Geographic Distribution**

*C. cyminum* is an erect or sub-erect annual herb. It grows 5 to 40 cm high. The green parts are usually covered with a bloom.<sup>2</sup> The seed-like fruit is elongated, oval and about 1/4th in long. The seeds are somewhat similar in appearance to caraway seed but longer.<sup>1</sup> This spice should not be confused with sweet cumin, which is a common name for anise (*Pimpinella anisum*). Black cumin (*Bunium persicum*) has smaller and sweeter seeds than *C. cyminum*.<sup>3</sup>

*C. cyminum* is native to the Mediterranean region, where it is extensively cultivated.<sup>2</sup> It is grown in India, Morocco, China, southern Russia, Indonesia, Japan, and Turkey. It is also cultivated in many parts of the world.<sup>1</sup>

In Ethiopia, cumin fruits are sold in markets, and small scale cultivation is common in small gardens near houses. This spice plant has been grown successfully at altitudes of 1,500 to 2,200 m.<sup>2</sup> It was introduced into Ethiopia long time ago. Its range of diversity, however,

is not known.<sup>4</sup>

### **Chemical Constituents**

Cumin seeds contain up to 5% volatile oils (cuminaldehyde, monoterpenes, and sesquiterpenes), 22% fats, free amino acids, and flavonoid glycosides. The chief aromatic constituents of the unheated whole seeds are 3-p-menthen-7-al, cuminaldehyde and related aldehydes. Fine grinding leads to loss of volatile oils, and hence the aroma.<sup>3</sup>

### **Culinary Uses**

Cumin seed was a valuable spice in ancient times. It is a major component of curry and chilli powders, and has been used to flavor a variety of commercial food products.<sup>1,3</sup> The oil which is obtained by steam distillation, is used to flavor alcoholic beverages, desserts, and condiments. It has also been used as a fragrance in creams, lotions, and perfumes.<sup>3</sup>

In Ethiopia, the ground seeds of cumin are used in small amounts to flavor *wot*.<sup>2</sup> Cumin is also used in the preparation of decorated pan bread (*ambasha*).<sup>5</sup>

### **Medicinal Uses**

Traditionally, cumin was used as a stimulant, antispasmodic, diuretic, aphrodisiac, for stimulating menstrual flow, treating diarrhea, colic, and flatulence.<sup>6</sup> Cumin seed appears to have anti-cancer effect as demonstrated by its ability to inhibit induction of gastric squamous cell carcinomas in mice. Cumin oil and cuminaldehyde have been reported to have larvicidal and antibacterial activities.<sup>3</sup> However, the effectiveness of cumin has not been definitively established.<sup>6</sup>

In Ethiopia, the pounded leaves of the plant are used to treat skin problems.<sup>2</sup>

### **Dosage and Adverse Reactions**

The typical dose is 5 to 10 fruits taken orally. Undiluted cumin oil is phototoxic.<sup>6</sup>

## Summary and Comments

Cumin is sold in local markets in Ethiopia. Its primary use is as a spice. It is also used medicinally to treat an unspecified skin condition. However, the medicinal use of cumin leaves needs more research to clarify the specific application and the scientific basis of such a use. There is no published study to support the medicinal use of cumin in Ethiopia.

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***Curcuma longa* L. syn. *C. domestica* Val., *C. aromatic*a  
(Family: Zingiberaceae)**

**Common Name (s):** Turmeric, curcuma, curcumin, Indian saffron

**Vernacular Name (s):** Ird

**General Notes, History, and Legends**

Turmeric was listed as a coloring plant in an Assyrian herbal of 600 B.C. In 1280, Marco Polo described turmeric growing in China:

*"There is a vegetable which has all the properties of saffron, as well the smell as the color, and yet it is not really saffron."*

In medieval times, turmeric was known in Europe as "Indian saffron."<sup>1</sup> Before litmus paper was introduced, turmeric was used in laboratories to test alkalinity in some perfumes.<sup>2</sup>

**Botany and Geographic Distribution**

Turmeric is a perennial member of the ginger family. It has a thick rhizome and grows to a height of 3 to 5 ft, with large oblong leaves. The flowers are yellow and funnel-shaped.<sup>3</sup>

The plant is distributed widely throughout Asia, India, China, and tropical countries.<sup>3</sup>

Turmeric has been successfully grown in Ethiopia.<sup>4</sup>

**Chemical Constituents**

Turmeric rhizome contains up to 7% of an orange-yellow volatile oil, comprised of tumerone (60%), isomers of atlantone and zingiberene (25%), and diaryl heptanoid compounds called curcuminoids (curcumin and related compounds). Curcuminoids are responsible for the yellow color.<sup>3</sup>

## Culinary Uses

Turmeric has long been used as a yellow food coloring and spice. It is one of the principal ingredients of curry powder.<sup>5</sup> Turmeric spice is prepared by grinding the orange-yellow waxy, short rhizomes into a fine aromatic powder, which is incorporated into curry powder. It is a colorful versatile product, combining the properties of a spice and the brilliant yellow dyestuff.<sup>1</sup> It has a warm, bitter taste. It is a component of some mustard products.<sup>3</sup>

In Ethiopia, it is used as a condiment used in making *alicha wot*.<sup>6</sup> It is used in the preparation of many food items, including pastry (*sambousa*),<sup>7</sup> mild beef stew (*ye siga alicha*),<sup>8</sup> mild fried beef stew (*t'ibs alicha*),<sup>9</sup> spiced ground beef stew (*minchet abish alicha*),<sup>10</sup> curried fish stew (*yasa alicha*),<sup>11</sup> pumpkin mild sauce (*ye duba alicha*),<sup>12</sup> split pea stew (*ye kik alicha*),<sup>13</sup> and lamb stew (*ye beg alicha*).<sup>14</sup>

## Medicinal Uses

There are many medicinal uses of turmeric. In folk medicine, the root is used to treat diarrhea, intermittent fever, edema, bronchitis, cold, worms, leprosy, kidney inflammation, cystitis, and cancer.<sup>15</sup> Turmeric has been reported to have tumor-preventing property when tested in hamsters. A fraction of curcuma oil has been shown to have anti-inflammatory and anti-arthritis activity in rat models. Curcumin has a slight antiedemic effect, and its choleric (bile stimulating) effect has been recognized for a long time.<sup>3</sup>

In Ethiopia, the grated roots of *C. longa* are used to treat "crying eyes" in children.<sup>16</sup>

## Dosage and Adverse Reactions

The typical dose of turmeric is 0.5 to 1 gm of the powdered root between meals up to 1.5 to 3.0 gm daily. Alternatively, 10 to 15 drops of the tincture is taken two or three times daily.<sup>15</sup>

In high doses and long-term use, turmeric can cause gastrointestinal side effects.<sup>15</sup>

## Summary and Comments

Turmeric is a key ingredient in curry powder. It is also used in perfumes. Turmeric is used to color and flavor various food products.

In Ethiopia, turmeric is used to flavor many types of mild sauces and stews known by the general local name "alicha." The medicinal effectiveness of turmeric has not been confirmed, except perhaps when used for dyspepsia.<sup>15</sup> Turmeric has a very limited medicinal use in Ethiopia, where it is valued more as a spice.

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***Foeniculum vulgare* Mill. syn. *Anethum foeniculum* L.,  
*F. officinale* All.  
(Family: Apiaceae or Umbelliferae)**

**Common Name (s):** Common, sweet or bitter fennel, carosela,  
Florence fennel, finocchio, garden fennel,  
large fennel, and wild fennel

**Vernacular Name (s):** Ensilal, kamun (A); kamuni, kamona (O);  
ensellal, silan (T)

**General Notes, History, and Legends**

*Foeniculum*, a diminutive form of the Latin *foenum*, means “small/fine hay,” indicating the hay-like dry leaves of the plant. *Anethum* in the synonym is probably derived from the Greek *aemi* which means “I breathe,” descriptive of the strong odor of the plant.<sup>1</sup> According to a Greek legend, man received his knowledge from Mount Olympus as a fiery coal enclosed in a stalk of fennel.<sup>2</sup> In ancient Greece, fennel was called “Marathon” to signify success. In 490 B.C., a famous battle was fought between the Greeks and Persians on a field covered with fennel plants just outside the town of Marathon, north of Athens.<sup>3</sup> In the Middle Ages, it was hung over doors to ward off evil spirits. Among the ancient Saxons, fennel was one of the nine sacred herbs. During the 16<sup>th</sup> century, it was used as a figurative term for flattery. The Italian expression *dare finnocio* meant “to give fennel,” or figuratively “to flatter.”<sup>4</sup>

**Botany and Geographic Distribution**

Fennel is an erect perennial herb reaching a height of about 2 m.<sup>1</sup> It has finely divided leaves composed of many linear or owl-shaped segments.<sup>5</sup> It is distinguished by this finely divided, feathery green foliage, and its golden yellow flowers. Fennel is closely related to dill (*Anethum graveolens*).<sup>4</sup> It is sweet smelling, especially after it is crushed.<sup>1</sup>

Fennel is native to southern Europe and the Mediterranean

area. Its cultivation has been reported from many countries.

In Ethiopia, it is a common perennial weed of the highland areas. It grows at 1,500 to 2,500 m above sea level. At these altitudes, it is resistant to light frosts and long dry periods. Fennel cultivated in Alemaya took about ten months before it was harvested. It grows abundantly in the wild.<sup>1</sup>

### **Chemical Constituents**

Fennel oil is a clear, colorless or light yellow aromatic mixture. It exhibits an initial bitter taste, followed by a sweet after-taste.<sup>1</sup> Fennel contains essential oils, consisting of up to 90% *trans*-anethole, up to 20% fenchone and small amounts of limonene, camphor,  $\alpha$ -pinene, and half a dozen other volatile oil components.<sup>5</sup> It is also rich in  $\beta$ -carotene and vitamin C.

### **Culinary Uses**

Since antiquity, the Chinese, Indians and Egyptians have used fennel as a condiment. The Romans had used the young shoots as a vegetable, and the herb is still popular in Italy. The whole or ground seeds are used to flavor bread, pastries, confectionery, soups, sweet pickles, and fish dishes. The oil from fennel is used as a flavoring agent in the manufacture of pickles, perfumes, soaps, liqueurs, cough drops, and licorice candies. The French use the young shoots in salads. In Italy, the thickened leaf stalks of finocchio (Florence fennel) are boiled, and then eaten as sweet vegetable.<sup>4</sup>

In Ethiopia, ground fruits of fennel are used to spice *wot*, while the ground fruits, young stems and leaves are mixed and used to flavor local alcoholic beverages such as *katikala, arake and tedj*.<sup>1</sup>

### **Medicinal Uses**

In the 1<sup>st</sup> century, Pliny mentioned that snakes ate fennel after shedding off their skin to regain their sight. He recommended fennel to improve eyesight.<sup>4</sup> In Chinese medicine, fennel has been used in combination formulas as a remedy for cholera, backache, and bed-wetting, while fennel powder has been used to treat snakebite. Fennel

has been used to enhance lactation, promote menstruation, facilitate birth, increase libido, treat indigestion, upper respiratory tract mucous membrane inflammation, cough, bronchitis, to stimulate appetite, treat visual problems, and colic in infants.<sup>6</sup> Fennel seeds have a long-standing reputation for counteracting the effects of poisons, boosting milk production, promoting menstruation, and increasing urination (as a diuretic or "water pill"). They are also used in suppressing appetite, a use once valued by the poor.<sup>7</sup>

The volatile oil of fennel has been shown to increase tracheal smooth muscle and ileal phasic contractions in the guinea pig.<sup>5</sup> The constituents anethole and fenchone may be responsible for reducing upper respiratory tract secretions.<sup>6</sup> This evidence may explain the effect of fennel in upper respiratory conditions, for which fennel is used traditionally. The main estrogenic component of fennel is thought to be a polymer of anethole.<sup>5</sup>

In Ethiopia, a decoction made from the roots is mixed with *tella* and drunk as a treatment for gonorrhea. It is also used on the umbilical cord of new-born babies. The leaves are boiled in coffee or tea and drunk, or the leaves are chewed for diuresis in gonorrhea, and as a laxative. The fruits are used as a diuretic, against headache, stomach pain, and coughs. The leaves are also spread on house floors for fragrance during festivities.<sup>1</sup>

### Dosage and Adverse Reactions

The usual oral dose is 5 to 7 gm of the dried fruits or seeds daily, or a cup of tea three times a day. The tea is prepared by steeping 1 to 2 gm of the crushed or ground fruit or seed in 150 ml of boiling water for 5 to 10 minutes, followed by straining. The daily dose of fennel oil is 0.1 to 0.6 ml, equivalent to 100 to 600 mg of the dried fruits or seeds.<sup>6</sup>

Fennel can cause skin and respiratory allergic reactions and photodermatitis. Allergic cross-sensitivity occurs in people who are allergic to carrots, celery, or other plants in the Apiaceae family.<sup>6</sup>

## Summary and Comments

Fennel has been used for a long time as a flavoring agent and as an herbal remedy. There is some evidence for the effectiveness of fennel when used for treating GI symptoms, flatulence, and upper respiratory tract mucous membrane inflammation.<sup>6</sup>

In Ethiopia, the use of fennel for diuresis in gonorrhea, stomachache, and cough may have some justification in view of the fact that the plant is used for the similar purposes elsewhere.

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***Lippia* spp.**  
**(Family: Verbenaceae)**

**Common Name (s):** Lemon verbena, louisa (for *Aloysia triphylla* (L'Herit.) Britt., formerly *Lippia citriodora* (Ort.) HBK, etc.

**Vernacular Name (s):** Kesse (*Lippia adoensis*, wild type).  
Kosseret (*Lippia adoensis*, cultivated type)  
Damakesse (*L. abyssinica* or *L. javanica*)

### **General Notes, History, and Legends**

Lemon verbena is lemon-scented, and hence the name. This particular species has been used as a medicinal agent for centuries.<sup>1</sup>

### **Botany and Geographic Distribution**

There are about 200 species of *Lippia*, which can be herbs, shrubs, or trees.<sup>2</sup> *L. citriodora* is a deciduous plant which grows to 3 m, with lemon-scented narrow leaves and small white flowers. It is cultivated in Europe and the tropics. It is grown commercially in France and North Africa.<sup>1</sup>

A few *Lippia* species have been reported to occur in Ethiopia. *L. adoensis* Hochst. ex Walp is endemic to the Afromontane regions of the country. It grows as a wild plant, or cultivated.<sup>2</sup> *L. abyssinica* (O. & D.) Cuf., *L. citriodora* and *L. javanica* (Burm f.) Sprengel are other species reported to be found in Ethiopia.<sup>3</sup>

### **Chemical Constituents**

The chemical profiles of cultivated *L. adoensis* (kesse) and wild *L. adoensis* (kosseret) are somewhat different. Gas chromatography-mass spectrometric analysis of the volatile constituents of the cultivated type showed the presence of citronellyl formate (1.8%), geraniol (0.5%), germacrene D (4.9%), linalool (68.3%), pulgeline (1%), and *trans*-caryophyllene (1.7%). On the other hand, gas chromatographic evaluation of the wild type indicated

## Dosage and Adverse Reactions

The common oral dose for *L. citriodora* is one cup of tea two to five times daily. The tea is prepared by steeping 5 to 29 gm of the leaf in 1 liter of boiling water for 10 to 15 minutes, followed by straining.<sup>4</sup> No dosages are available for other *Lippia* species.

*L. citriodora* may irritate the kidneys during excretion. It may also cause contact dermatitis.<sup>4</sup>

## Summary and Comments

*Lippia* species are used as a fragrance, food and beverage flavoring.

In Ethiopia, they are used to flavor *wot*, butter, and *kitfo*. Certain *Lippia* species are also used medicinally. The fact that *L. citriodora* has been used elsewhere as antipyretic and for other cold symptoms may justify similar traditional use of the plant in Ethiopia.

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***Mentha* spp.**  
**(Family: Labiateae)**

**Common Name (s):** Peppermint, brandy mint, lamb mint:  
(For *M. piperita* L.)

Spearmint, curled mint, fish mint, garden mint,  
Mackerel mint, Our Lady's Mint.

Sage of Bethlehem, Spire Mint, Yerba buena:  
(For *M. spicata* L.)

Pennyroyal, squamint, squaw balm, squamint  
tickweed, mosquito plant, pudding grass,  
Run-by-the-Ground, Lurk-in-the Ditch (For *M. pulegium* L.)

English horsemint [For *M. longifolia* (L.) Nath.]

Wild mint, water mint, marsh mint, hairy mint  
(For *M. aquatica* L.)

**Vernacular Name (s):** Nanna (A); anna (O); semhal (T) for *M. longifolia*; koricha lega (O) for *M. aquatica*

**General Notes, History, and Legends**

The genus name *Mentha* is derived from Minthes, a charming nymph in classical mythology who was transformed into the mint plant by a suspicious and jealous Proserpina, the wife of Pluto.<sup>1</sup>

During the Greco-Roman era, spearmint and horsemint leaves were crushed on tabletops for their aroma and to express hospitality. Ancient Hebrews scattered mint leaves on synagogue floors to produce a fragrant smell.<sup>1</sup> Mint is mentioned in the Holy Bible:

“Woe unto you, Pharisees! For ye tithe  
mint and rue and all manner of herbs,

*and pass over judgment and the love of God"*  
(Luke 11:42)

## Botany and Geographic Distribution

The prototypical member of the mint family (Labiate) is *M. piperita* (peppermint), which is sometimes expressed as *M x piperita* to indicate its hybrid nature between *M. spicata* L. (spearmint) and *M. aquatica* L. All mints have squarish purple-green stems with dark or light green leaves, and purple and lilac-colored flowers. The leaves are very aromatic.<sup>2</sup>

*M. pulegium* grows to 10 to 40 cm high, and the leaves are elliptical. It is a creeping perennial herb.<sup>3</sup>

*M. longifolia* has a sturdy rhizome with underground runners.<sup>4</sup>

*M. aquatica* is a perennial plant 20 to 80 cm high, with a branched rhizome and an erect stem and curly leaves. It has the smell of caraway.<sup>5</sup>

Peppermint is a perennial plant indigenous to Europe and the Mediterranean region, and is naturalized in temperate regions.<sup>1</sup> *M. pulegium* grows in western, southern and central Europe, Asia, Arabian countries, and Ethiopia. It is naturalized in America. *M. longifolia* is common in Europe. *M. aquatica* is found in Europe, North Africa, western Asia, and is introduced to America, Australia and Madeira.<sup>3,4,5</sup>

In Ethiopia, an unidentified *Mentha* species (vernacular name: *nanna*) appears to be widespread and cultivated in many home gardens.<sup>6</sup> *M. longifolia*, *M. piperita*,<sup>7</sup> *M. pulegium*,<sup>6,8</sup> and *M. aquatica*<sup>9</sup> are also reported to occur in Ethiopia.

## Chemical Constituents

The chemistry of peppermint oil, steam-distilled from *M. piperita*, is rather complex and variable. Over a hundred compounds have been reported from the oil. The relative yields of these compounds depend on the climate, cultivars and geographic location.<sup>2</sup> The chief components are menthol (35% to 45%), menthone (15% to 20%), menthyl acetate (3% to 5%), neomenthol (2.5% to 3.5%), isomenthone (2% to 3%), and menthofurane (2% to 7%). Other

important constituents include limonene, pulegone,  $\alpha$  and  $\beta$ -pinene, and *trans*-sabinene hydrate.<sup>10</sup> The pharmacologically active tannins, bitter substances, caffeic acid, and flavonoids are known to occur in *M. piperita*.<sup>2</sup>

The yield of pennyroyal oil from *M. pulegium* is 1% to 2%. It contains D-pulegone (60% to 90%), menthone (10% to 20%) and isomenthone (2% to 10%). Other constituents include octanol, piperitenone, pinene, limonene, dipentene, and formic, butyric, salicylic and other acids.<sup>11</sup> The plant also contains tannins and flavonoids.<sup>3</sup>

A GC analysis of the volatile oil constituents of a sample of *M. pulegium* obtained from Essential Oil Research Center of Ethiopia (EORC) showed the presence of pulegone (56.5%), isomenthone (24.5%), menthone (6.8%), and iso-pulegone (3.7%).<sup>6</sup>

The volatile oil of *M. longifolia* contains as chief constituents piperitone (60% to 80%),  $\beta$ -caryophyllene (5% to 15%), germacrene D (5% to 15%), 1,8-cineole (2% to 7%), and limonene (1% to 8%). The plant also contains flavonoids.<sup>4</sup>

*M. aquatica* contains the volatile oil constituents menthofurane,  $\beta$ -caryophyllene, 1,8-cineole, germacrene D, limonene, and viridiflorol. The plant also contains tannins.<sup>5</sup>

Analysis of the volatile oil constituents of an unknown Ethiopian *Mentha* species, known by the vernacular name *nanna*, showed the presence of carvone (56.8%) and cineole (23.4%) as major constituents.<sup>6</sup>

GC-MS analysis of the volatile of a sample of *M. arvensis* L. obtained from EORC, Ethiopia revealed the presence of menthol (87%) and methyl acetate (10%) as major constituents.<sup>6</sup>

## Culinary Uses

Peppermint oil has a fresh, strong, sweet and tangy flavor and taste. It is used to flavor candy, confectionery, perfumes, and liqueurs.<sup>1</sup> It is also used for flavoring chewing gums, toothpaste, mouthwashes, cigarettes, and pharmaceuticals.<sup>2</sup> Peppermint is used in foods, beverages, and herbal teas as a spice. When used in specified amounts

in foods, both peppermint leaves and the oil have GRAS status. The maximum level of peppermint oil allowed in candies is 0.104%.<sup>12</sup>

*Mentha pulegium* (pennyroyal) has been used as a spice in foods, and as a fragrant in detergents, perfumes, and soaps.<sup>11</sup> Pulegone-free American pennyroyal oil is allowed only in alcoholic beverages in Canada. However, the Council of Europe considers pennyroyal oil as a food flavoring agent without referring to the toxicity associated with its use.<sup>13</sup>

In Ethiopia, *nanna* is used in teas.<sup>6</sup> *M. longifolia*, *M. piperita* and an unidentified *Mentha* species are used as condiments in tea.<sup>14</sup> The whole plant of *M. aquatica* is used as a flavoring agent.<sup>8</sup> *M. pulegium* is used as a fragrance.<sup>8</sup>

## Medicinal Uses

In Eastern and Western traditional medicine, peppermint (*M. piperita*) and its oil have been used to treat indigestion, nausea, sore throat, cold, toothache, cramps, cancer, as an antispasmodic and antiseptic. Today, the oil is used as an ingredient in pharmaceutical cough and cold preparations, and as a carminative for use in irritable bowel syndromes. The oil is used as an inhalant for symptomatic treatment of cold and cough. Topically, menthol, a major constituent of peppermint oil, in low concentrations causes a cooling sensation, an effect observed when shaving creams containing menthol are used. In high concentrations, however, it causes irritation and vasodilation. The latter effect is helpful when active ingredients in topical products containing menthol need to be absorbed.<sup>2</sup>

Pennyroyal (*M. pulegium*) has been used as an insect repellent and antiseptic. It has also been reported to be used as an emenagogue, carminative, stimulant, antispasmodic, and for bowel disorders, skin eruptions, pneumonia and other conditions.<sup>11</sup> Pulegone, a major constituent of the oil, has been reported to be hepatotoxic and neurotoxic. It may also damage bronchiolar epithelial cells.<sup>13</sup>

English horsemint (*M. longifolia*) has been used for digestive disorders, flatulence, pain, and headaches.<sup>4</sup>

The wild mint plant, (*M. aquatica*) is used for diarrhea and

dysmenorrhea.<sup>5</sup>

In Ethiopia, an unidentified *Mentha* species is used for the treatment of common cold and headache.<sup>7</sup>

### Dosage and Adverse Reactions

For upset stomach, the typical oral dose of peppermint is one cup of tea three to four times daily. It can also be taken at meal times as needed. The tea is prepared by steeping one teaspoon of the dried leaves in 150 ml boiling water for 10 minutes and then straining. The average daily dose of the leaves is 3 to 6 gm. The usual dose of the tincture (1:5 in 45% ethanol) is 2 to 3 ml three times daily.<sup>12</sup>

For digestive disorders, the typical dose of peppermint oil is 0.2 to 0.4 ml diluted in water 3 times daily. For irritable bowel syndrome, 0.2 to 0.4 ml is taken three times a day between meals. For topical use, a small amount of 5-20% semi solid and oily preparations, 5-10% aqueous-ethanol preparations, or 1-5% nasal ointments is rubbed into the affected area. For tension headaches, an ethanolic 10% preparation is applied on the forehead and temples, and repeated after 15 and 30 minutes thereafter. For inhalation, 3 to 4 drops of the oil in hot water is used. There is no typical dose for pennyroyal.<sup>12</sup>

Peppermint tea can cause unpleasant choking sensation in infants and children due to the menthol content. It can also worsen colic in people with gall stones. When taken orally, peppermint oil can cause heartburn, flushing, and headache. It can also worsen the symptoms of hiatal hernia. When topically used, the oil can cause irritation and contact dermatitis. Application of the oil to the face, nasal or chest areas of babies and children can cause respiratory tract spasms and collapse. Allergic reactions can also occur when the oil is inhaled.<sup>12</sup>

### Summary and Comments

*Mentha* species are found in many countries. The various species contain several volatile oil compounds, a fact which makes them useful not only in foods and beverages, but also in cosmetic and pharmaceutical products. Peppermint oil is an important ingredient of

modern cough and cold pharmaceutical preparations.

Peppermint is possibly effective in GI, gall bladder and bile duct spasms. The oil is deemed to be effective in irritable bowel syndrome, post-operative nausea, spastic discomfort of the GI tract and bile ducts. When applied topically, it may be effective for inflammation of the oral mucosa, myalgia, neurological coughs, colds, and tension headaches.<sup>12</sup> The effectiveness of pennyroyal and its oil has not been confirmed.

In Ethiopia, several *Mentha* species are found. They are primarily used to flavor teas and as a fragrance. The use of *Mentha* species in Ethiopia for common cold and headache is consistent with similar use in other countries, which is also supported by scientific reports.

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***Myristica fragrans* Houtt.**  
**(Family: Myristicaceae)**

**Common Name (s):** Nutmeg, mace, nux moschata

**Vernacular Name (s):** Gewz (A)

**General Notes, History, and Legends**

The fruit of *M. fragrans*, when ripe, gives a bright-red aril (spice mace) enclosing a shell, which in turn encloses a nut. The dried nut produces the spice nutmeg.<sup>1</sup> Therefore, it is actually two spices in one plant.

Pliny, in the 1<sup>st</sup> century A.D., probably alluding to what we know today as *M. fragrans*, wrote about a “comacum” tree with a fragrant nut and a perfume of two kinds. During the 6<sup>th</sup> century A.D., Arab traders were involved in importing nutmeg and mace from the East Indies to Constantinople. These spices were well known in Europe by the end of the 12<sup>th</sup> century. There is a record which indicates that in 1191 the streets of Rome were fumigated with the fragrance of nutmeg and other aromatic spices in preparation for the coronation of Emperor Henry VI.<sup>2</sup>

In the 16<sup>th</sup> century, the Portuguese controlled the trade of mace and nutmeg, which were obtained from the island of Banda in the Moluccas. In the 17<sup>th</sup> century, the Dutch took over the production and sell of these spices. It is interesting, nay amusing, to note that a Dutch colonial administration official of the time, who did not know that both mace and nutmeg were from the same plant, ordered that the locals in the Moluccas grow less number of nutmeg trees, and plant more mace trees!<sup>2</sup>

**Botany and Geographic Distribution**

The nutmeg is an evergreen tree, which can grow to over 60 ft.<sup>1</sup> The fleshy fruit is lemon yellow to light brown. When ripe, the fruit splits open, exposing the brilliant scarlet membrane (aril), known as the mace. The aril encloses a dark brown brittle shell, inside of which

is found a glossy brown oily seed, the nutmeg. The fragrant seeds measure about 1.25 in long and 0.75 in wide. The aromatic mace is about 1.5 in long and 1/6th in thick.<sup>2</sup>

The plant grows in India, Sri Lanka, and other parts of the East Indies. It also grows in Grenada and other islands in the Caribbean (the West Indies).<sup>3</sup>

*M. fragrans* does not grow in Ethiopia; it is imported.<sup>4</sup> However, there had been a suggestion that it could potentially be grown.<sup>5</sup>

### Chemical Constituents

Nutmeg seed contains 20% to 40% fixed oil called nutmeg butter, consisting of myristic acid and triglycerides of lauric, tridecanoic, stearic, and palmitic acids. The seed nut also contains 8% to 15% of an essential oil, which includes *d*-camphene, dipentene, myristicin, elemicin, iso-elemicin, *d,l*-pinene, geraniol, eugenol, isoeugenol, safrole, limonene, sabinene, cymene,  $\alpha$ -thugene,  $\gamma$ -terpinene, and monoterpene alcohols. Mace and mace oil have many of the components that nutmeg and its oil have, but with higher myristicin content in the oil and less fixed oil in the intact mace.<sup>1</sup>

### Culinary Uses

Nutmeg and mace are used as culinary spices. They are used in Indian cooking.<sup>1</sup> Both are sweet, warm, spicy in flavor. Nutmeg appears to be sweeter and more delicate in aroma than mace. The organoleptic variation may be attributed to the slight difference in the essential oil composition.<sup>2</sup>

Nutmeg and mace are used in baking. They are also used to flavor meat products, soups, sauces, and preserves. Nutmeg is used as a spice in dairy products such as eggnog, junkets, puddings, and fruit pies. Mace is a favored condiment in pound cakes, fish sauces, meat stuffing, and oyster stew.<sup>2</sup>

The maximum safe limit of nutmeg or mace, or their respective oils is 0.3%. They have GRAS status in the USA.<sup>6</sup>

In Ethiopia, nutmeg is used as a spice.<sup>4</sup> It is also mixed with

other spices and added to *wot* to accent the taste. Nutmeg is an ingredient of spice blends,<sup>7</sup> and is also used in the preparation of steamed light bread (*hibisti*).<sup>8</sup>

### Medicinal Uses

As most other spices, nutmeg and mace have multiple popular medicinal applications. They are used internally for diarrhea, gastric spasm, flatulence, gastric mucosal inflammation, nausea, kidney complaints, cancer, as a tonic, and hallucinogen. Nutmeg has been used to induce menstruation, for insomnia, and as an abortifacient. Topically, it has been used for mouth sores, while mace has been used topically for rheumatism.<sup>6</sup>

Myristicin appears to be the psychoactive component, but other constituents like eugenol and geraniol may have a role in the hallucinogenic effect. Another suggestion that has been put forth for this effect is the presence of allyl benzene components, which bear structural similarity to amphetamine-like compounds.<sup>1</sup>

Geraniol, a component of the volatile oil, is a more potent antiemetic (antinauseant) than ipecac. Nutmeg extracts, eugenol, and isoeugenol exhibit anti-prostaglandin activity. Nutmeg has been used to decrease calcium levels in individuals with diarrhea and chronic hypercalcemia secondary to thyroid medullary tumors.<sup>6</sup> Safrole, a minor component of the oil, has been shown to promote hepatocarcinomas in mice.<sup>1</sup>

In Ethiopia, nutmeg has been reported to be used in the treatment pneumonia.<sup>4</sup>

### Dosage and Adverse Reactions

For flatulence, the typical oral dose is 0.03 ml of nutmeg oil. For nausea, gastric upset, or diarrhea, the usual dose is 3 to 5 drops of the essential oil. For diarrhea, 4 to 6 tablespoon of the powder can be taken daily.<sup>6</sup> The usual oral dose of powdered nutmeg or mace is 0.3 to 1 gm.<sup>9</sup>

Oral intake of 5 gm or more of either nutmeg or mace powder can cause a number of adverse reactions, including weak pulse,

hypothermia, disorientation, euphoria, nausea and vomiting, epigastric pain, tachycardia, seizures, flush, miosis, agitation, hyperactivity, and hallucinations. Ingestion of large amounts can cause abortions, coma, or death. Topical application of nutmeg can cause allergic reactions.<sup>6</sup>

## Summary and Comments

Nutmeg has been used as a spice in foods. It is safe in amounts usually used in foods. Its effectiveness as a medicinal agent, however, has not been established.<sup>6</sup>

In Ethiopia, nutmeg is used as an ingredient in spice blends. It is added to *wot* to accent the taste. It has been used for the treatment of pneumonia. Its effectiveness, however, has not been reported. When ingested in large amounts, nutmeg is a toxic plant.

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***Nigella sativa* L.**  
**(Family: Ranunculaceae)**

**Common Name (s):** Ajenuz, black seed, black cumin, charnushka, black caraway (not true caraway), barraka (the black seed), fitch (Biblical name), ‘love in the mist,’ Comhino Negro, fennel flower, nutmeg flower, Roman-coriander

**Vernacular Name (s):** Tiquur azmud (A); habasudu, abosuda, guji guracha, gurati, gura (O), aaf (Kaffa), awoseta (T)

### **General Notes, History, and Legends**

*Nigella* is the female diminutive form of “niger” (=black) which means blackish, referring to the color of the seeds. *Sativa* is derived from a Latin word which means “sown, planted, cultivated.”<sup>1</sup> *N. sativa* has been used since as far back as 1,400 years ago. Ancient Egyptians believed that it played a role after life. *N. sativa* was found in the tomb of King Tutankhamen.<sup>2</sup>

### **Botany and Geographic Distribution**

*N. sativa* is an annual herb, 30 to 60 cm tall, with terminal grayish-brown flowers. It has a well developed yellow-brown tap root with many side roots. Enclosed in a toothed pod are 3-sided, 1 to 3 mm long, 5 to 12 mm wide (diameter), dark-black seeds.<sup>1,2</sup>

*N. sativa* is perhaps indigenous to the Mediterranean region. It is cultivated in various parts of the world, including central and southern Europe, former USSR, northern Africa, the Sudan, Ethiopia, Kenya, Somalia, Djibouti, Syria, Iran, Afghanistan, and India.<sup>1</sup>

In Ethiopia, *N. sativa* sometimes grows as an escape. It may also be indigenous. It is cultivated in Begemdir, (Dembia and Gondar), Shewa (Alem-gena), Bale (Dinsho), Hararghe (Chercher), and Keffa (Jimma) at altitudes of 1,500 to 2,500 m as a rain-fed crop. It is often grown along with barley and wheat. The seeds are also sold in local

markets.<sup>1</sup>

### Chemical Constituents

*N. sativa* seeds contain thymoquinone, nigellone, nigellimine N-oxide (isoquinolone alkaloid), other alkaloids, melantin (a saponin), linoleic and oleic acids (84%), volatile oils (1.4%), palmitic, glutamic, stearic and ascorbic acids, arginine, methionine, lysine, glycine, leucine, and phytosterols.<sup>2</sup>

### Culinary Uses

The seeds of *N. sativa* have been used as a spice since long time ago. They have a strong pungent and carrot-like smell. They are used in spicing bread in India, Sri Lanka, Egypt, and the former USSR. In many Eastern countries, the seeds are used to flavor vinegar, curry, or as a substitute for pepper in cooking.<sup>2</sup>

*Tikur azmud* seeds are used in Ethiopia to flavor bread, to spice capsicum pepper sauce, curry sauce, *wot*, and to flavor local beverages. They are added to capsicum powder to reduce its pungency, and to add flavor and color. *Tikur azmud* seed powder is added to *wot* towards the end of the latter's preparation. The seeds are added to alcoholic beverages like *arake* and *katikala* along with other spices like black pepper, Ethiopian cardamom, and ginger.<sup>1</sup>

### Medicinal Uses

In the 1<sup>st</sup> century A.D., the Greek physician Dioscorides documented that *N. sativa* seeds were used for headache, toothache, nasal congestion, and intestinal worms.<sup>2</sup> People use the seeds orally for gastrointestinal problems such as gas, colic, diarrhea, dysentery, constipation, and hemorrhoids. They are also used orally for asthma, allergies, cough, bronchitis, emphysema, flu, and congestion. Other uses include for treating hypertension, cancer, and as immunoprotectant, contraceptive, and for stimulation of menstruation, and increase of milk flow. Topically, they are used as anti-inflammatory, for headache, and skin conditions.<sup>3</sup>

It has been reported that nigellone, a constituent of *N. sativa* in

low concentrations inhibits the release of histamine from mast cells. The volatile oil portion (with thymoquinone removed) has also been shown to exhibit respiratory stimulant effect in guinea pigs.<sup>2</sup> A fixed oil obtained from the seeds has demonstrated anti-eicosanoid and antioxidant effects, thus supporting the traditional topical use as an anti-inflammatory agent. The reduction of arterial blood pressure recorded in rats after administration of *N. sativa* seeds may also explain the traditional use as an anti-hypertensive remedy. Anti-tumor activity against certain carcinomas *in vitro* has also been shown. A study has shown that *N. sativa* seeds have anti-oxytocic activity in rats thus inhibiting contraction. Another report indicated that when rats are fed the seeds, pregnancy was prevented 1 to 10 days post-coitus.<sup>2</sup>

In Ethiopia, *tikur azmud* is used for relief from headache. For this purpose, the seeds are mixed with melted butter, wrapped in a piece of cloth and sniffed.<sup>4</sup> The seeds are also used to induce abortion.<sup>1</sup>

### Dosage and Adverse Reactions

There is no typical dose for *N. sativa*. Topical use of the oil can cause allergic contact dermatitis. *N. sativa* may also cause hepatotoxicity.<sup>3</sup>

### Summary and Comments

*N. sativa* is an important spice, commonly used to add flavor to bread. Medicinally, it is used for many complaints. However, there is no evidence of effectiveness for many of its uses.

In Ethiopia, *tigur azumd* is used in the preparation of bread, as an ingredient of curry and pepper sauce, and to flavor local alcoholic beverages. Medicinally, it is used to treat headache and induce abortion. It has been used for headache in other countries for headache. There is some evidence for the anti-oxytocic potential of *N. sativa*, which may lend some support to the use of *tigur azmud* in Ethiopia to induce abortion.

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***Ocimum basilicum* L.**  
**(Family: Labiate or Lamiaceae)**

**Common Name (s):** Basil, common basil, sweet basil, garden basil, St. Josephwort

**Vernacular Name (s):** Besobila, ajuban, zakakewe (A); kasse, kefo, kendama, urgo, zahahene (O); sessak, seseg (T), rehan (S)

### General Notes, History, and Legends

*Ocimum* is derived from “*okimon*,” a Greek name for *Ocimum* plants. It may also be a derivation of the Greek word “*akinos*,” which means “to smell” or “sharp” indicating the odor of the plant.<sup>1</sup> *Basilicum* may have come from the Greek *basileus* which means “king,” suggesting the plant belonged to the king’s quarters because of its pleasant smell. The shortened form of *basilicus* referred to a venomous snake that could kill with a glance!<sup>2</sup>

Basil has been associated with both good and evil stories. For example, known by the local name *tulsi*, basil is a revered plant in India. Arabian physicians of the Middle Ages recommended basil for various diseases.<sup>2</sup>

On the other hand, basil has also been mentioned in association with strange stories. In the Middle Ages, people believed that scorpions would breed where basil grew. Hilarius, a French physician believed that the smell of basil would make scorpions grow in the brain. Salome is said to have concealed the head of John the Baptist in a pot of basil. In “*Isabella, or the Pot of Basil*” by Keats, Isabella hides the severed head of her lover Lorenzo:

“She wrapp’d it up; and for its tomb did choose  
 A garden-pot, wherein she laid it by.  
 And cover’d it with mold, and o’er it set  
 Sweet Basil, which her tears ever kept wet.”

## Botany and Geographic Distribution

*O. basilicum* is an annual spicy herb, profusely branched and reaching a height of about 2 ft. The leaves are glossy, grayish-green beneath and up to 2 in long and 3/4th in wide. The flowers are small, greenish- or purplish-white in color.<sup>2</sup> The aerial parts smell sweet.<sup>1</sup>

The genus *Ocimum* constitutes about 30 species, which are spread out in tropical and subtropical areas.<sup>3</sup> The taxonomy of this genus and species delineation within it have rather been complex. This problem also applies to *O. basilicum*. In the past, taxonomists had suggested several taxa at the variety and subvariety levels within *O. basilicum*. While retaining the name *O. basilicum* to what he called "the *besobila* group," Jansen proposed four groups of basil in Ethiopia, which would be closely related to *O. basilicum*. He provided certain distinguishing characteristics of these groups.<sup>1</sup> However, he did not give these groups formal revision and official taxonomic status.

The number of *Ocimum* species occurring in Ethiopia is not accurately known, perhaps because of the afore-mentioned taxonomic problems. According to Demissew and Asfaw, there are nine indigenous species in Ethiopia.<sup>4</sup> It has also been suggested that there are at least five species. *O. basilicum* (*besobila*) is the most important of these. Two other species, *O. ladiense* and *O. sacrum* are both known by the Amharic vernacular name "kasse." *O. sarcum* is used to flavor butter, and to scent houses by spreading on the floors. *O. ladiense* is burnt as an incense for its aroma and to expel gnats.<sup>5</sup>

*O. basilicum* has also been divided into two varieties, and assigned to an undefined group along with the closely related *O. canum* Sims, *O. forskolei* Benth., and *O. stirbeyi* Schweinf. and Volkens. In the same manner, *O. gratissimum* L. (Holy Basil) has been lumped with *O. urticofolium* Roth (syn *O. suave* Willd.), *O. lamifolium* Hochst., *O. triendon* Baker ex Gurke, *O. spicatum* Deflers, and *O. jamesii* Sebald. All these species are found in Ethiopia in the wild or cultivated.<sup>6</sup>

In Ethiopia, the vernacular name *besobila* was used in reference to *O. basilicum*. However, this vernacular name has recently been used in association with the species *O. americanum*,<sup>3</sup> which in

earlier literature was considered a synonym for *O. basilicum*.<sup>1</sup> The vernacular name *ajuban* is now used to refer to *O. basilicum*.<sup>3</sup>

*O. basilicum* is thought to have originated from India, Iran, or Afghanistan. It has now a worldwide distribution. It has been cultivated in many countries. It also grows in the wild.<sup>1</sup>

In Ethiopia, the plant grows in the wild and in cultivation. Small-scale cultivation is common near houses. It can be cultivated at altitudes of up to 2,000 m. The fresh and dried plants are offered for sale in local market.<sup>1</sup>

## Chemical Constituents

Basil contains cinnamte, methyl chavicol, ocimene, cineole, linalool, and xanthmicrol. The essential oil contains up to 85% estragole (methyl chavicol). Basil is a rich source of vitamin C, calcium, magnesium, potassium, and iron.<sup>7</sup>

Essential oil analysis of an Ethiopian sample of *O. basilicum*, (besobila) similar in chemistry to the French basil, showed estragole (49.6%) and linalool (45.1%) as major constituents. The other volatile constituents include 1,8-cineole (1.1%),  $\alpha$ -bergamotene (0.8%), and methyl cinnamate (0.7%). Similar analysis of a sample of *O. americanum* (ajuban) revealed the presence of linalool (35.7%), methyl cinnamate (34.3%), estragole (8.9%), 1,8-cineole (6.8%), carvacol (6.4%), and  $\alpha$ -humulene (1.2%).<sup>3</sup> Thus, it is evident from these data that the two species have varying ratios of volatile oil constituents.

## Culinary Uses

Basil has a warm, sweet, and highly aromatic flavor. The leaves are used to flavor stews, sauces, sausages, dressings, salad, and mock turtle soup. Basil is used in tomato-based recipes. It is also an ingredient in the Italian speciality *Chicken Cacciatore*.<sup>2</sup> In Indonesia, the leaves are used to flavor fish and meat, while the seeds are used in the preparation of cold drinks.<sup>1</sup> In the United States, the oil or oleoresin has a GRAS status when used in foods at levels below 0.005%.<sup>7</sup>

In Ethiopia, the fresh and dried inflorescence and leaves are commonly used in the preparation of *wot*. The leaves, flowers and fruits and tender stems are dried, ground, and added to sauces.<sup>1</sup> Basil is used in the preparation of green pepper paste (*tikur qaria awaze*),<sup>8</sup> multi-ingredient red pepper (*berbere*),<sup>9</sup> red pepper paste (*awaze*),<sup>10</sup> spiced oil (*yetenetere zeyt*),<sup>11</sup> and spiced hot powdered peas (*mitin shiro*).<sup>12</sup>

### Medicinal Uses

In Chinese medicine, basil is used for stomach spasms, kidney conditions, to promote blood circulation before and after childbirth, and to treat snake and insect bites. The aboveground parts are used in folk medicine as an antiflatulent, diuretic, lactation stimulant, gargle and mouth astringent, and in maggot-infested nasal disease. It is also used to treat head colds, worm infestation, and as an appetite stimulant and as a cure for warts.<sup>7</sup> The mucilage obtained from basil is used for cough, against diarrhea, and intestinal complaints.<sup>1</sup>

The constituents methyl cinnamate, methyl chavicol, ocimene, cineole, and linalool have insecticidal properties. It has been reported that the volatile oil constituents of basil may have antagonistic activity on worms. The constituent xanthmicrol may have cytotoxic and antineoplastic activities.<sup>7</sup>

In Ethiopia, basil is used for malaria, headache and as an insect repellent.<sup>1</sup> The species *O. forskolei* is used for malaria, headache and diarrhea. The fresh leaves of *O. lamifolium* are squeezed and the juice sniffed to treat colds and coughs, while the eyes are rinsed with the juice for eye infections. The crushed leaves of this plant are inserted in the nostrils to arrest nose bleeding.<sup>4</sup> The species *O. urticifolium*, (known by the local Oromiffa name *chebicha* or *wehale*) has been used by the Zay people in Ethiopia to treat febrile conditions. The plant is grown in home gardens by the Zay people mainly for this purpose.<sup>13</sup>

### Dosage and Adverse Reactions

The typical oral dose of basil leaf for stomach distension is one

cup of fresh tea two to three times daily between meals. The tea is prepared by steeping 2 to 4 gm of the leaves in 150 ml of boiling water for 10 to 15 minutes, followed by straining. For chronic flatulence, one cup is taken two to three times daily between meals for eight days, stopped for 14 days, and then resumed for eight more days with the same dose.<sup>7</sup>

Basil has been reported to cause low blood sugar levels. Long-term use can precipitate other adverse reactions.<sup>7</sup>

### Summary and Comments

Historically, basil has been an important plant. It is used to spice foods and beverages. It is also used as a traditional herbal remedy, especially in Chinese traditional medicine. Reliable evidence is lacking in the literature on the effectiveness of basil in many of the complaints it is used for.<sup>7</sup>

In Ethiopia, there are at least six *Ocimum* species available. The taxonomy of *Ocimum* is rather complex. Basil is used in the preparation of *wot* and various other dishes. Certain species are used medicinally for diarrhea, colds, cough, headache, eye infections, and as an insect repellent. There is some evidence on the insecticidal properties of some volatile oil constituents of basil. People in other societies have also used basil for head colds, diarrhea, and cough, which may give an indirect ethnobotanical justification (not necessarily scientific) for similar uses in Ethiopia.

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***Pimpinella anisum* L.**  
**(Family: Umbelliferae or Apiaceae)**

**Common Name (s):** Anise, anise seed, sweet cumin, anise fructus, phytoestrogen, semen anisi

**Vernacular Name (s):** Insilal (A)

**General Notes, History, and Legends**

*P. anisum* has been known in Egypt for about 4000 years.<sup>1</sup> Anise was used as a flavoring agent in 1<sup>st</sup> century Rome. In 1305, King Edward imposed a tax on anise, which was collected for the repair of the London Bridge. In accounts of 1408, it was recorded that anise was used to perfume the personal linen of King Edward IV.<sup>2</sup>

In Ethiopia, *P. anisum* is known by the vernacular name *insilal*, which is also used for *Foeniculum vulgare*.<sup>3,4</sup>

**Botany and Geographic Distribution**

Anise is a graceful annual herb that can grow to a height of 3 ft, with leathery leaves.<sup>2</sup> The flowers are yellow. The ridged seeds are greenish-brown and 2 mm long. Anise has a licorice-like aromatic taste.<sup>1</sup>

*P. anisum* is cultivated throughout the world. It is indigenous to Asia Minor, Greece, and Egypt. Mexico, Spain, Germany, Turkey, and Italy produce large amounts of anise.<sup>2</sup>

In Ethiopia, anise is a common weed in highland areas. It is occasionally cultivated at altitudinal range of 1,500 to 5,000 m.<sup>5</sup>

**Chemical Constituents**

The dried fruits of *P. anisum* yield 1% to 4% anise oil by steam distillation. *Trans-anethole* (75% to 90%) is the major component responsible for the taste, smell and medicinal properties of the herb. Other components of the oil include estragole (methyl chavicol, 1% to 2%), anise ketone (*p*-methoxyphenyl acetone),  $\beta$ -caryophyllene, anisaldehyde, anisic acid, limonene,  $\alpha$ -pinene, acetaldehyde, *p*-cresol

and myristicin. Further constituents known to occur *P. anisum* are umbelliferone, umbellipreine, bergapten, scopoletin, fatty acids,  $\beta$ -amyrin, stigmasterol, rutin, isorientin, and isovitexin.<sup>1</sup>

### Culinary Uses

Anise oil is used in flavoring licorice. It is commonly used in foods, soups, confectionery, cough drops, and liqueurs. The popular Turkish alcoholic beverage *raki* contains anise as a flavoring ingredient. In Latin America, anise is a popular flavoring agent in alcoholic beverages.<sup>2</sup>

Anise seed is used as a whole or ground up. The whole seed is used to flavor soups and cakes. The leaves can be used to season salads.<sup>2</sup> In the United States, anise is GRAS-listed, and is approved for use in food.<sup>5</sup>

In Ethiopia, the ground seeds are used to flavor *wot*. It is also used in the preparation of local alcoholic beverages such as *katikala*, *arake*, and *tedj*.<sup>4</sup>

### Medicinal Uses

Anise is used for dyspepsia, as a pediatric antiflatulent, expectorant, and topically for lice, scabies, and psoriasis. In folk medicine, it has been used to increase lactation, induce menstruation, facilitate birth, and increase libido. Its estrogenic activity may be due to anethole and its polymers.<sup>5</sup> Anethole is also known to inhibit mycotoxin-producing *Aspergillus* in culture. A well-known carminative and expectorant, anise is used to decrease bloating and settle the digestive tract, especially in children.<sup>1</sup>

Anise is used in dentifrices as an antiseptic, and in lozenges and cough preparations for its weak antibacterial effect. In higher doses, anise is used as an antispasmodic, and as an antiseptic for cough, asthma and bronchitis. Anethole has structural resemblance with catechol amines such as adrenaline, nor-adrenaline and dopamine; due to this, anise exhibits sympathomimetic effects.<sup>1</sup>

In Ethiopia, no medicinal use for *P. anisum* has been recorded. However, the vernacular name *ensilal* has been used for other species

also, in which case the medicinal attributes recorded for the vernacular *ensilal*, may also apply to *P. anisum*.

### Dosage and Adverse Reactions

The commonly used oral dose of anise is 0.5 to 1 gm of the dried fruit, or as a tea three times daily. The tea is prepared by steeping 1 to 2 teaspoon of the crushed seeds in 150 ml boiling water for 10 to 15 minutes, followed by straining. The expectorant dose is a cup of tea in the morning and at night. For antiflatulent effect, 1 tablespoon of the tea is taken several times daily. The typical oral dose for nursing babies and infants is one teaspoon of the tea.<sup>5</sup>

Anise can cause allergic reactions, such as skin, respiratory, and gastrointestinal reactions, as well as photosensitivity. High doses of anise can cause adverse neurological effects. Nausea, vomiting, seizures, and pulmonary edema can be caused by ingestion of 1 to 5 ml of anise oil.<sup>5</sup>

### Summary and Comments

Anise is a popular flavoring agent in alcoholic drinks, foods and cough drops. It is likely effective as an expectorant and antispasmodic.<sup>5</sup> There is also evidence for its antibacterial property.<sup>1</sup>

Anise, known also by the local name *ensilal*, is used in Ethiopia to flavor *wot* and alcoholic beverages. No medicinal use of anise in Ethiopia has been reported.

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***Piper longum* L.**  
**(Family: Piperaceae)**

**Common Name (s):** Indian long pepper, long pepper

**Vernacular Name (s):** Timiz (A)

**General Notes, History, and Legends**

Long pepper, along with other peppers, was one of the earliest articles of commerce between the Orient and the Europe. It was so important that in 176 A.D. the Romans had to impose a customs duty on it in Alexandria. Long pepper (from northern India) was known before black pepper (from southern India) in the Greco-Roman era, and was regarded as being superior in quality to black pepper.<sup>1</sup> It is said that Alexander the Great had his first taste of long pepper when he invaded India. The genus name *Piper* may have originated from “*pipari*,” a name given in Persia, and presumably a mispronunciation of the Indian name “*pipali*” for long pepper. Long pepper is not used in the West as a spice.<sup>2</sup>

**Botany and Geographic Distribution**

*P. longum* is a climbing vine. It grows in about the same areas as white/black pepper. It originated from India.<sup>2</sup>

In Ethiopia, this plant grows in Keffa, Illubabur, Wollega, and parts of Gamu Gofa at altitudinal range of 1,500 to 2,000 m above sea level. Its range of diversity is not known. Its natural habitat may also be endangered.<sup>3</sup>

**Chemical Constituents**

Piperine is the chief constituent found in long pepper. This compound is also found in *P. nigrum* (black/white pepper), but not in red pepper and cayenne.<sup>4</sup> The constituents piperine, piperidine and chavicin are known to produce the typical fiery flavor.<sup>2</sup>

## Culinary Uses

*P. longum* is used in foods as a spice. The fresh or dried form of the spice is used for this purpose.<sup>4</sup> In India, it is used in curries and sauces.<sup>2</sup>

In Ethiopia, the inflorescence of *P. longum* is used to spice *wot*. Its relatively low price and comparable taste make it a good substitute for black pepper.<sup>3</sup>

## Medicinal Uses

*P. longum* is reported to have a rather long list of medicinal uses. In folk medicine, the fruits are used to stimulate menstrual flow, appetite and bile flow, to improve digestion, induce sweating, as an abortifacient, analgesic, antiflatulent, aphrodisiac, astringent, bactericide, diuretic, larvicide, sedative, stimulant, tonic, and vermifuge. *P. longum* is also used to treat headache, toothache, asthma, beriberi, bronchitis, mucous membrane inflammation, cholera, comma, cough, diarrhea, dysentery, epilepsy, fever, frigidity, stomachache, stroke, heartburn, indigestion, insomnia, leprosy, lethargy, enlarged spleen, muscle pain, nasal discharge, painful menses, paralysis, psoriasis, sterility in women, snake bites, tetanus, thirst, tuberculosis, and tumors.<sup>4</sup>

An ethanolic extract of *P. longum* and piperine have demonstrated amoebicidal activity. In mice, an ethanolic extract has been shown to increase sperm count and motility.<sup>4</sup>

In Ethiopia, it appears that no medicinal use has been reported.

## Dosage and Adverse Reactions

No typical dose has been reported for *P. longum*. There are also no reported adverse reactions, including allergies.<sup>4</sup>

## Summary and Comments

Long pepper is used to spice foods, especially curries and sauces in India. It has a long list of medicinal uses. However, the effectiveness has not been confirmed.<sup>4</sup>

In Ethiopia, long pepper (*timiz*) is used as a cheap substitute for

black pepper in flavoring *wot*. No indigenous medicinal use of *timiz* in Ethiopia has been reported.

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***Piper nigrum* L.**  
**(Family: Piperaceae)**

**Common Name (s):** Black pepper, white pepper, piper, peppercorn

**Vernacular Name (s):** Qundo berbere (A)

**General Notes, History, and Legends**

*P. nigrum* is the true pepper. It should not be confused with capsicum peppers, Jamaican pepper (*Pimenta dioica*) and Melegueta pepper (*Amomum melegueta*).<sup>1</sup>

**Botany and Geographic Distribution**

*P. nigrum* is a vine that produces berries in clusters. The berries are picked either green (not fully ripe), or after they are ripened. The unripe peppercorns give *black pepper* after processing, while the ripened berries give *white pepper*. A woody climber, *P. nigrum* grows to 30 ft high or more, with a grayish stem of up to  $\frac{1}{2}$  in diameter. The leaves are dark green above and pale green underneath.<sup>1</sup>

*P. nigrum* is native to the damp jungles of south-western India. It is cultivated in tropical areas. It grows in a moist, hot climate at altitudes of up to 1,500 ft above sea level.<sup>1</sup>

In Ethiopia, trials to grow *P. nigrum* at Jimma Agricultural Research Unit had shown promising results.<sup>2</sup>

**Chemical Constituents**

Piperine

**Culinary Uses**

*P. nigrum* is the world's most important spice, due to its availability and versatility. It is often added to food just before preparation, or as seasoning when food is served. Whole peppercorn spices are added to meats, soups, fish, and pickles. The spice has a hot, biting and pungent taste.<sup>1</sup> It is also added to beverages as a flavoring.<sup>3</sup>

In Ethiopia, it is used in the preparation of spiced powdered pepper (*afrinj*),<sup>4</sup> collard green mixed in spiced cottage cheese (*ayib*

*begomen*),<sup>5</sup> dried meat (*quanta*),<sup>6</sup> spiced barley meal (*chiko*),<sup>7</sup> bread made with special minced fish sauce (*yasa dabbo*),<sup>8</sup> and grilled ribs and beef stew (*insirsir*)<sup>9</sup>.

### Medicinal Uses

Traditionally, black pepper and white pepper are used orally to treat cancer. Other uses include for treatment of stomach disorders, digestive problems, and bronchitis. Topically, it is used for treating neuralgia and scabies.<sup>3</sup>

*P. nigrum* fruits are believed to have antiflatulent, diuretic, antimicrobial, and insecticidal properties. Some evidence suggests that this spice might be protective against colon cancer. Other evidence suggests it might cause liver cancer.<sup>3</sup>

In Ethiopia, *P. nigrum* is used an ingredient in a multi-spice preparation, which is used for the treatment of mental illness.<sup>10</sup> It is also used by itself and in combination with other two plants as an aid in fortune telling, and to acquire wealth/have good married life, respectively!<sup>11</sup>

### Dosage and Adverse Reactions

The typical single oral dose ranges from 300 mg to 1.5 gm per day.<sup>3</sup>

When taken orally, *P. nigrum* can cause a burning after-taste. In contact with the eyes, it can cause redness, as well as swelling of the eyelids. Deaths due to inhalation of large amounts of pepper have been reported.<sup>3</sup>

### Summary and Comments

*P. nigrum* is a versatile spice. It is used in foods prior to, or during preparation. It can also be added as a seasoning after food is served. It is used in beverages, as well. There is no reliable evidence on the effectiveness of *P. nigrum*, when used medicinally.<sup>3</sup>

*P. nigrum* (*qundo berbere*) is used in Ethiopia as a spice. It is used in Ethiopian traditional medicine for superstitious benefits. However, there is no reported data to support its effectiveness.

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***Rhamnus prinoides* L' Hérit.**  
**(Family: Rhamnaceae)**

**Common Name (s):** Buckthorn

**Vernacular Name (s):** Gesho

**General Notes, History, and Legends**

The genus name *Rhamnus* is derived from the Greek word *rhamos* which means "bush," or from the Celtic word *ram*, which means a "a tuft of branches." The specific epithet *prinoides* indicates the leathery nature of the leaves.<sup>1</sup> *R. prinoides* was a plant included in the long list of plants collected in Ethiopia by James Bruce in the late 18<sup>th</sup> century.<sup>2</sup>

*R. prinoides* is commonly found in eastern, central and western Africa.<sup>3</sup> It is found in different parts of Ethiopia, both in the wild and as a cultivated plant. It grows at elevations of 1,400 to 3,200 m above sea level, in the montane and riverine forest on the edges of clearings. The closely related species *R. staddo* A. Rich. (vernacular name, *tsedo*) occurs only in the wild at the edges of montane forest in wooded and scrub land in many parts of Ethiopia. *R. prinoides* is cultivated on a large scale as a field crop.<sup>4</sup> It is also grown in home gardens. According to a 1977 report, about 40% of *gesho* was cultivated by small farmers. The leafy branches are sold fresh, or dried.<sup>1</sup>

**Chemical Constituents**

The leaves of *R. prinoides* have yielded several compounds, including geshodin, chrysophenol, emodin, musizin, and rhamnocitrin, while the fruits contain anthracene derivatives, prinoidin, biprinoidin, rhamnazin, and C-rhamnosides. Geshodin is the constituent that imparts bitterness to *tella*, a popular local alcoholic beverage which has *gesho* as its main ingredient.<sup>3</sup>

**Culinary Uses**

Although *R. prinoides* is widespread in Africa, it is only in

Ethiopia that it finds use as a spice.<sup>5</sup> However, it has been reported that the roots are used by the Chagga in South Africa to enhance the potency of beer.<sup>1</sup> *Gesho* is widely used in Ethiopian households in the preparation of *tella*, *tedj*, or even the strong alcoholic beverage *arake*. The leaves and the stems are used to brew *tella* and *tedj*, respectively.<sup>1,3</sup> The root-bark of *R. staddo* (*tsedo*) is used for seasoning *tedj*. The average alcoholic content of *tella* is estimated to be 7% by volume.<sup>1</sup> Other estimates put the alcoholic contents of *tella*, "filtered" *tella*, *tedj*, *arake*, and "redistilled *arake*" at 2% to 3.5%, 5% to 6%, 6% to 9%, 22% to 28% and 45% to 50%, respectively.<sup>6</sup> Details of brewing various types of *tedj* and *arake* have been provided in the literature.<sup>1,7</sup> Typically, *tella* is prepared from water, malt, flour, and *gesho*. If *tella* is used three days after preparation, it is called *gush tella*. Usually, it is allowed to stand for seven days for fermentation to be complete before it is served.<sup>1</sup>

It has been shown that beer prepared by incorporating 80% of regular hop and 20% *gesho*, exhibits likeable hedonic qualities.<sup>3</sup> It may also be interesting to note that hops (*Humulus lupulus L.*), which is used to produce industrial beer, contains humulone and lupelone. The alleged sedative properties of hops have never been confirmed.<sup>8</sup>

## Medicinal Uses

In South Africa, the Zulu use the root of *R. prinoides* to "cleanse the blood," and the leaves to treat simple sprains, while the Sotho use the root to treat pneumonia. The Masai use the root to treat gonorrhea. An extract of the root is used by the Chagga for the relief of muscular rheumatism. In Angola, the bark is used to induce vomiting.<sup>1</sup>

In Ethiopia, *gesho* finds use as a laxative, diuretic, and prophylactic agent against syphilis, as a depurative, and a cholagogue. In children, moistened *gesho* leaves are placed in the mouth to relieve pain symptoms associated with tonsilitis and tonsillectomy.<sup>1</sup>

## Dosage and Adverse Reactions

There is no typical dosage for *R. prinoides*. Adverse reactions

have not been reported.

### Summary and Comments

*R. prinoides* is a useful ingredient in the Ethiopian alcoholic beverages *tella*, *tedj*, and *arake*. It provides flavor and typical bitterness to these popular drinks. *Gesho* is also used for a number of health conditions, but there seems to be no scientific report to support the alleged benefits.

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***Ruta chalepensis* L.**  
**(Family: Rutaceae)**

**Common Name (s):** Rue, herb of grace

**Vernacular Name (s):** Tenadam, adam, taladam, gulla (A), dehn, tenadam (T), talatam, talles, dscharta (O)

**General Notes, History, and Legends**

“*Ruta*” is an old Latin name for the rue plant. It means bitterness, unpleasantness, which may refer to the strong smell and taste of rue. According to Jansen, *Ruta graveolens*, which morphologically resembles *R. chalepensis*, has not been recorded in Ethiopia. He claims, however, that “the use and growth of *R. chalepensis* is almost identical” to that of *R. graveolens*.<sup>1</sup> It has been reported that the two are separate species, although it appears that they have been treated interchangeably.<sup>2</sup> In this monograph, a distinction is made in the treatment of rue wherever applicable, including the respective phytochemistry of the two species.

In the 1<sup>st</sup> century A.D., the Roman naturalist Pliny the Elder mentioned remedies containing rue (perhaps *R. graveolens*). In ancient Greece and Egypt, rue has been used for medicinal purposes.<sup>3</sup>

**Botany and Geographic Distribution**

*R. chalepensis* and *R. graveolens* look similar, although the latter has a diagnostic characteristic of the petals being denticulate, rather than fimbriate. *R. chalepensis* is an erect perennial herb, woody at the base, and measuring up to 1.5 m high. All green parts are glabrous and glandular punctate, often with a waxy layer. It has a strong smell.<sup>1</sup>

*R. graveolens* is native to Europe, but cultivated worldwide. It grows along roadsides in waste areas. The plant is both ornamental and medicinal.<sup>3</sup>

*R. chalepensis* is indigenous to the Mediterranean area, the Canary Islands, Arabia, and Somalia. It is cultivated in many countries. It grows in the wild on warm, dry limestone, slopes and fields. It grows

in these habitats in Turkey up to 300 m and in France up to 500 m above sea level.<sup>1</sup>

In Ethiopia, it is cultivated at altitudes between 1,500 and 2,000 m above sea level. It grows in every part of the country. An easy growing plant, it is cultivated near houses that have gardens.<sup>1</sup>

### Chemical Constituents

Many compounds have been isolated from the rue plant. *R. graveolens* contains a mixture of furoquinolone alkaloids (1.5%), with arborine, arborinene, and  $\gamma$ -fagarine being the principal ones. The acridone alkaloids rutacridone epoxide and hydroxyrutacridone epoxide are concentrated in the roots. The alkaloids graveoline, graveolinine, kokusaginine, rutacridone, and skimmianine have also been isolated. The flavonoid rutin is also found in this plant. The volatile oil (0.1%) contains 90% of methyl-nonylketone and 10% of other ketones, esters, and phenols. Other constituents of *R. graveolens* include furocoumarins, such as bergapten, psoralen, xanthoxantin, xanthotoxin, isopimpinellin, and rutamarin.<sup>3</sup>

*R. chaleensis* contains a bitter volatile oil in varying amounts; up to 0.6% in the wild type, up to 0.08% in fresh cultivated plants, and up to 0.1% in dry cultivated plants. The oil composition is about 80% methyl-*n*-heptylketone and about 10% methyl-nonylketone.<sup>1</sup> Notice that the significant difference in the content of methyl-nonylketone between the two *Ruta* species.

*R. chaleensis* also contains the flavonoid rutin. The fresh leaves contain 0.3% of vitamin C.<sup>1</sup>

### Culinary Uses

Rue (*R. graveolens*) and its oil are used in foods and beverages as flavor components. In manufacturing, the oil is used as a fragrance ingredient in soaps and cosmetics.<sup>4</sup> The Romans used rue as a spice. In Europe, it is sometimes used as a spice in cakes and salads.<sup>1</sup>

In Ethiopia, the use of *tenadom* as a spice is common. The fruits are used as an ingredient in the popular spice mix *berbere* (*capsicum* sauce). The leaves are added to sour milk to make cheese (locally known as *irgo*). The fresh leaves are used to flavor *kuti*, a local

beverage made by infusing coffee leaves.<sup>1</sup> They are also used to add flavor to creamed coffee.<sup>5</sup>

### Medicinal Uses

Rue is used for a range of complaints. The leaves and other parts of rue have been used for hundreds of years as insect repellents, and in folk medicine as antispasmodics, sedatives, and stimulants of the onset of menses. In some cultures, the extracts have been used as abortifacients. In New Mexico, rue has been used traditionally as a tisane to treat stiff neck, dizziness, headache, tightness in the stomach, and inner ear problems. The oil was once used against intestinal worms.<sup>3</sup> Among its so many uses, the above-ground parts of rue have been used for circulatory disorders, heart palpitations, diarrhea, cramps, earache, nervousness, and hysteria. Topically, rue is used for arthritis, dislocations, sprains, injuries of the bone, inflammation of the skin, oral, and pharyngeal cavities, ear aches, toothaches, tumors, and worts. Rutin, a constituent of both species, has shown some evidence of antispasmodic activity.<sup>4</sup>

In Ethiopia, rue (*R. chalepensis*) is considered a useful medicinal plant. It is used for heart pain, earache, and intestinal disorders. The dried and ground fruits are boiled in milk and taken for diarrhea. Colicky babies are treated with the juice of crushed leaves mixed with water. The plant is boiled in *tella*, or mixed with *wot*, and used against influenza. The ground plant material is an ingredient of an ointment, which is used to treat hemorrhoids.<sup>1</sup>

More than 15 compounds have been identified as having significant *in vitro* antibacterial and antifungal activity. The acridone alkaloids are the most potent antimicrobial compounds, while the coumarin constituents showed activity only at higher doses.<sup>3</sup> There is some evidence to suggest that the abortifacient activity of *R. graveolens* may be due to a constituent called chalepensin working via anti-implantation mechanism, or through generalized fetal death.<sup>3,4</sup> The anthelmintic activity of rue may be due to the constituent 2-undecanone found in the oil. The rue constituent rutin may have antispasmodic action, and may also possess the ability to decrease capillary permeability and fragility.<sup>4</sup>

## Dosage and Adverse Reactions

The typical oral dose of rue is 500 mg of the crushed herb, with the maximum daily dose being 1 gm. Alternatively, one cup of the cold tea can be taken daily. The tea is prepared by pouring a cup of boiling water over 1 teaspoon of the herb.<sup>4</sup>

Rue can cause gastrointestinal irritation, sleep disorders, dizziness, spasms, and severe kidney and liver damage. The fresh leaf juice can cause fainting, lethargy, bradycardia, abortion, and swelling of the tongue. The oil causes severe stomach pain, vomiting, exhaustion, confusions, and convulsions. Ingestion of over 100 ml of the oil, or 120 g of the leaf can cause vomiting, gastric pain, systemic complications, and death. Contact dermatitis can occur with the use of rue. Topical exposure to rue, followed by sunlight exposure can cause phototoxic skin blistering reactions.<sup>4</sup> Rue (*R. graveolens*) is considered as a toxic herb. It is thus generally recommended not to be used medicinally.<sup>6</sup>

## Summary and Comments

Rue has been used in folk medicine for a long time, although it has a limited use as a spice. It has been used as an antispasmodic, sedative, abortifacient, to mention some of its uses. There is no reliable evidence for its effectiveness; however, there are reports on its antispasmodic and anti-implantation properties.

In Ethiopia, *R. chalepensis* is used commonly as an ingredient in a spice mix, as well as to add flavor to sour milk and coffee. It appears that there is some evidence supporting its use in colicky babies. The rutin constituent may be responsible for this benefit. *R. graveolens* has been used in other societies for earache and other complaints, which may provide ethnomedical justification of the use of the related *R. chalepensis* for earache in Ethiopia.

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***Syzygium aromaticum* L. syn *Caryophyllus aromaticus*,  
*Eugenia caryophyllata*, *E. aromatica***  
**(Family: Myrtaceae)**

**Common Name (s):** Clove, caryophylus

**Vernacular Name (s):** Qirunfud

**General Notes, History, and Legends**

“Clove” is derived from the french word “clou,” meaning nail. The name corresponds to the nail-shaped flower bud. During the Hun period in China in the 3<sup>rd</sup> century B.C., the plant was known by the name “chicken-tongue spice,” perhaps because of its numbing effect on the tongue when the whole clove is chewed. In the 4<sup>th</sup> century A.D., Emperor Constantine is said to have given St. Silvester, Bishop of Rome at the time, 150 pounds of cloves.<sup>1</sup>

In the 16<sup>th</sup> century, the Portuguese for the most part controlled the trade of cloves, which originated in the Moluccas (Spice Islands). “The Moluccas” refers to a group of volcanic islands in the East Indian Archipelago (now eastern Indonesia). The Dutch, through their Dutch East India Company, later replaced the Portuguese. A Frenchman by the name Pierre Poivre smuggled clove seedlings from the Moluccas into Mauritius (now Madagascar), from where it spread to Zanzibar (now Tanzania). Thus, the Dutch monopoly was broken. Madagascar and Tanzania became major producers of cloves.<sup>1,2</sup>

**Botany and Geographic Distribution**

The clove plant is an evergreen tree, grows up to 20 m high, and has leathery leaves. The spice is obtained from the dried flower buds. These buds are 22 mm long, with four projecting calyx lobes. The four petals above the lobes fold over to form a hood-like structure, which covers the stamens.<sup>3</sup> The bud is picked as a spice just before the pinkish-green blossom opens.<sup>1</sup>

The plant grows in warm climates, and is cultivated in Tanzania, Sumatra, the Molucca Islands and South America.<sup>3</sup>

The clove plant does not grow in Ethiopia. However, cloves

(*qirunfud*) are widely used as a spice.

### Chemical Constituents

The volatile oil constituent of clove buds ranges from 15% to 20%. The stems and the leaves yield in turn about 5% and 2% of the oil. The principal constituent of distilled clove bud oil is eugenol (60% to 90%). Other constituents of the oil include acetyleneugenol, gallic acid, sesquiterpenes, furfural, vanillin, methyl-*n*-amyl-ketone, flavonoids, carbohydrates, lipids, oleanolic acid, rhamnetin, and vitamins. The volatile oil is responsible for the smell and aroma of the clove buds.<sup>3</sup>

### Culinary Uses

In manufacturing, clove (dried flower bud, leaf, and stem) is used as a flavoring in foods, beverages, and cigarettes. Clove oil is used for fragrance in toothpastes, cosmetics, and perfumes.<sup>4</sup> Cloves are used as a common condiment and flavoring spice in most regional cuisines.<sup>3</sup> Clove has a GRAS status in the USA for use in foods.<sup>4</sup>

In Ethiopia, clove seeds are an ingredient of red pepper blend (*berbere*),<sup>5</sup> red pepper paste (*awaze*),<sup>6</sup> and are used in the preparation of spiced hot powdered peas (*mitin shiro*),<sup>7</sup> very hot pepper mix (*mitmita*),<sup>8</sup> spiced barley meal (*chiko*),<sup>9</sup> coffee (*buna*),<sup>10</sup> chicken bread (*ye doro dabbo*),<sup>11</sup> and fried beef stew (*tibs wot*).<sup>12</sup>

### Medicinal Uses

Topically, clove is used for toothache, as a counterirritant, and for mouth and throat inflammation. It is also used topically as part of a multi-ingredient preparation (SS Cream) to treat pre-mature ejaculation in men (see Cinnamon monograph). Traditionally, it has been used to treat flatulence, nausea, vomiting, and as an expectorant.<sup>4</sup> Clove oil continues to be used in dentistry as an analgesic and local anesthetic.<sup>3</sup>

A 15% tincture of cloves has been shown to be effective in treating topical ringworm infections. Clove oil, like many other volatile oils, has been shown to inhibit gram-positive and gram-negative bacteria. Its fungistatic activity has also been demonstrated.

Whole cloves were found to be chemopreventive against liver and bone marrow toxicity in mice. Eugenol, a major constituent of clove, scavenges reactive oxygen generated by macrophages during inflammatory process, thus reducing inflammation. It has also been found to have significant antipyretic activity, comparable to acetaminophen. Reports have indicated antithrombotic activity of clove oil via inhibition of platelet aggregation by eugenol.<sup>3</sup>

In Ethiopia, clove has been used by itself for unspecified eye diseases, or is mixed with juice of aloes and applied to the eyes for eye complaints.<sup>13</sup> Cloves are also powdered, mixed with water, and applied as hair growth stimulant. They can also be charred with lichen growing on *Podocarpus gracilis*, mixed with water to a paste consistency and applied to stimulate eyelash and eyebrow growth.<sup>14</sup>

### Dosage and Adverse Reactions

The typical oral dose is 120 to 300 mg. Mouthwashes contain 1 to 5% clove essential oils. Athlete's foot is treated with a 15% clove tincture. The oral dose for clove can be 5 to 30 drops of the fluid extract, and ½ to 1 ounce of a mouth rinse containing clove oil.<sup>4</sup> For toothache, the undiluted oil is applied to the affected area.<sup>15</sup>

Inhalation of cloves can cause hemoptysis, bronchospasm, hemorrhagic and non-hemorrhagic pulmonary edema, pleural effusion, respiratory infection, and aspiration of foreign material. When used topically, it can cause irritation. Sporadic erectile dysfunction, excessively delayed ejaculation, mild pain, and local irritation and burning have been reported with the use of SS cream.<sup>4</sup>

Oral use of clove oil can cause depression, seizures, lactic acidosis, disseminated intravascular coagulation, hepatic dysfunction, and irritation of the mucosal tissues. Topical use of the oil can cause mucosal tissue and skin irritation. Use of the oil in the oral cavity can damage the mucosa, cause sensitivity and irritation, and damage the dental pulp or the supporting periodontium.<sup>4</sup>

### Summary and Comments

Cloves have a long history of culinary and medicinal use. They are used as a common condiment to flavor food and beverages. In

traditional medicine, cloves have been used for many complaints, including premature ejaculation in males when used as a component in a multi-ingredient preparation. The latter use has been supported experimentally. Other uses of cloves have not been verified for effectiveness.<sup>4</sup>

In Ethiopia, cloves are used as a spice in many food preparations. They have also been used for eye problems and as hair growth stimulants. The effectiveness of cloves in these applications has not been confirmed.

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***Tamarindus indica* L.**  
**(Family: Leguminosae or Fabaceae)**

**Common Name (s):** Tamarind, tamarindo, imlee

**Vernacular Name (s):** Homar (A); Roka (O), Rogai (Sodo),  
Tamare-hindi (Arabic)

### **General Notes, History, and Legends**

*Tamarindus* was probably derived from the Italian, Portuguese, or Spanish word *tamarindo*, which in turn was derived from the Arabic *tamare-hindi*, meaning “Indian date.” It was named so, because of the dark-brown fruit pulp, which reminded the Arabs of the familiar date. *Indica* is derived from the Latin *Indus*, which means Indian.<sup>1</sup>

### **Botany and Geographic Distribution**

*T. indica* is a large evergreen tree reaching a height of 30 m. The crown of the tree is densely foliated, wide and rounded. The fruits are up to 14 cm long, 4 cm in diameter, and up to 10-seeded. The seeds are hard, up to 18x12x7 mm and trapezoidal in shape. The tree is majestic and reportedly hurricane-resistant.<sup>1</sup>

The origin of tamarind is not accurately known, but it is believed to be indigenous to the dry savannas of tropical Africa. It may also be indigenous to India and Indonesia; however, there is no conclusive evidence to support this claim. It was certainly introduced to tropical America. It is only in India that the tree is cultivated on a plantation scale. The plant grows in tropical East Africa at sea level, and all the way up to 1,520 m above. It is well adapted to semi-arid tropical areas. Very arid or very humid areas do not support the growth of *T. indica*.<sup>1</sup>

In Ethiopia, it is found at sea level, as well as at altitudes up to 1,300 m above. It often grows along with *Commiphora*, *Acacia*, *Delonix*, *Terminalia*, and *Gyrocarpus* species. It grows in all provinces. It can be found all year round, with the flowering season being during the small rainy season from March to July. The fruits come out from September to April. This plant is not cultivated in

Ethiopia; it grows in the wild, where the fruits are collected. The fruits are sold in local markets.<sup>1</sup> It is one of the plants that forms the canopy of the riverine forest along the Awash River; *T. indica* is also found in the large riverine forest in the Lower Omo Valley.<sup>2</sup>

### Chemical Constituents

The fruits of tamarind contain *d*-tartaric acid and other acids, sugars, pectin, protein, vitamins, and minerals. The volatile oil portion consists of over 60 compounds, including methyl salicylate and safrole.<sup>3</sup> The bark has about 7% tannins.<sup>4</sup>

### Culinary Uses

The fruits of *T. indica* have a citrus-like aroma and a sweet spice-like taste.<sup>1</sup> Tamarind is used as a flavoring agent in foods and beverages. It is commonly used in Asian cuisine for chutneys.<sup>3</sup> The leaves and flowers have been used in salads, curries, and soups. The pulp of the fruit is either eaten fresh, or after mixing with sugar. The mixture with sugar is used to season foods, curries, preserves, chutneys and sauces, and to prepare jams and syrups. It also makes a refreshing acidic drink.<sup>1</sup>

In Ethiopia, the use of tamarind as a spice is limited. However, the fruits are sold in local markets to be eaten, or to make drinks.<sup>4</sup>

### Medicinal Uses

People use tamarind for chronic or acute constipation, liver and gall bladder disorders, and to decrease fever. A paste made from the seeds is topically used as a caste for broken bones. The Chinese use it for pregnancy-induced nausea and as an anthelmintic in children, while in Arabia it is used for stomach disorders, colds, and fevers.<sup>3</sup> The roots are used against sleeping sickness, and as a component of a poison antidote. In Nigeria, they are used as an ingredient of an anti-leprosy medicine. In Tanzania, they are used for heat pain. A decoction made from the roots is used as a cough and fever remedy in East Africa and the Sudan. In some African countries, the bark is used against soar throat, asthma, and leprosy. A decoction of the wood is used as a purgative, and the wood ash is used against gonorrhea. A

decoction of the leaves is used in Madagascar and Zaire to treat fever. The sap is used against diarrhea, dysentery, intestinal worms, and eye diseases. The powdered leaves are made into a decoction, and used to treat wounds and abscesses. The leaves are also used against rheumatism, bronchitis, and cough. The flowers are a remedy for jaundice, eye diseases, wounds, and intestinal problems. In Mauritius, the pulp is used against rheumatism, and as an antiscorbutic in India, while the old bulb is used as an abortive agent in Indonesia. The seeds are used against dysentery in India and Senegal, against rheumatism in India, and on wounds, ulcers, and furuncles in Ceylon and the Sudan.<sup>1</sup>

There is some evidence which indicates that an aqueous extract of the fruits is highly toxic toward *Schistosoma mansoni*, and the carrier snail *Bulinus trucatus*. Another report has claimed tamarindienal, a constituent of tamarind, might have antifungal activity against *Aspergillus niger* and *Candida albicans*, and antibacterial activity against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*.<sup>3</sup>

In Ethiopia, the fruits (pulp) are used as a laxative and to treat fever. The pulp is also used for diarrhea, dysentery, malaria, wounds, and hemorrhoids. The powdered seeds are used for the treatment of dysentery.<sup>1</sup> The Dizi and the Suri ethnic groups in Keffa, southwestern Ethiopia also use tamarind for stomach pain. The fruits are crushed, mixed with water and drunk for this effect.<sup>5</sup>

### Dosage and Adverse Reactions

As a laxative, 10 to 50 g of tamarind paste is taken orally. The paste is prepared from the fermented fruits of *T. indica*.<sup>3</sup> The typical dose of tamarind is 4 to 8 gm daily.<sup>6</sup>

No adverse reactions have been reported.<sup>3</sup>

### Summary and Comments

Tamarind is used in Asian cuisines as a popular flavoring agent. It is also used medicinally for a number of complaints, including constipation, fever, colds, etc. It is widely used in folk medicine in some African countries, including those in East Africa. There are no reports which confirm the effectiveness of tamarind in many of its

therapeutic applications.

In Ethiopia, tamarind has been used to a limited extent to make flavored drinks. It has also been used to treat constipation, fever, malaria, just to mention a few of its uses. The fact that tamarind is used as a remedy for constipation and fever in other countries may justify its use for similar complaints in Ethiopia. There are no scientific reports on these attributes of the plant.

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***Thymus schimperi* Ron.  
*Thymus serrulatus* Hochst. ex Beth.  
(Family Labiatae or Lamiaceae)**

**Common Name (s):** Abyssinian thyme

**Vernacular Name (s):** Tosign for *T. schimperi*; Tesni, Thasne for *T. serrulatus*

**General Notes, History, and Legends**

The name *thyme*, which is derived from Greek, refers to courage, sacrifice and fumigation.

Thyme was an incense used to purify temples. In ancient Greece, it was regarded as a symbol of courage and bravery. It is believed that thyme was found in the hay and straw bed in which Virgin Mary and Child Christ rested. In medieval times, thyme was used to signify the courage of knights in the days of chivalry.<sup>1</sup>

**Botany and Geographic Distribution**

Both *T. schimperi* and *T. serrulatus* are perennial herbs, woody at the base and 5 to 40 cm high. They have a crowded inflorescence with pink corollas. *T. schimperi* has ovate to elliptic leaves with entire margins.<sup>2</sup>

Well over a hundred species of thyme and their hybrids are known to occur throughout the world.<sup>1</sup> However, they are uncommon in the African tropics.<sup>2</sup> Outside of Ethiopia, known by the common names thyme, rubbed thyme, Spanish thyme, and Thymi Herba, the species *Thymus vulgaris* and *Thymus zygis* are the commercial sources of thyme and thyme oil.<sup>3</sup>

*T. schimperi* and *T. serrulatus* are indigenous to Ethiopia. They are endemic to the highlands, and are found on edges of roads, in open grasslands and on slopes. They occur at altitudinal range of 2,200 and 4,000 m above sea level. *T. schimperi* is widespread in central, eastern and northern Ethiopia, while *T. serrulatus* is restricted to the northern parts of the country.<sup>2</sup>

## Chemical Constituents

Analysis of the volatile oil constituents of *T. schimperi* collected in Bale, Gondar, Shewa and Wello indicated the presence of *p*-cymene (9.23%),  $\gamma$ -terpinene (8% to 17%), thymol (6% to 38%), and carvacol (5% to 63%). The oil from *T. serrulatus* was found to contain *p*-cymene (13%),  $\gamma$ -terpinene (13%), thymol (49%) as major constituents.<sup>4</sup>

*T. vulgaris* contains a volatile oil (1.0% to 2.5%), whose constituents are *p*-cymene (14% to 45%), thymol (20% to 55%), carvacol (1% to 10%), borneol (up to 8%), and linalool (up to 8%). Other non-volatile constituents include caffeic acid derivatives (rosmarinic acid, etc.), flavonoids (luteolin, apigenin, naringenin, circilineol, circumatin, and thymonin), and triterpenes (ursolic acid and oleanolic acid).<sup>5</sup>

It is noteworthy to compare the volatile oil constituent profiles of the two Ethiopian *Thymus* species with that of *T. vulgaris*, which are somewhat similar.

## Culinary Uses

Thyme and thyme oil are GRAS-listed in the USA, when used in specified amount in foods. The maximum allowable level of thyme in foods is 0.172%, and that of thyme oil is 0.003%. In manufacturing, red thyme oil is used in soaps, cosmetics, toothpastes, and as a flavor component in foods.<sup>3</sup>

In Ethiopia, the fresh and dried leaves of both *T. schimperi* and *T. serrulatus* are used as flavoring ingredients of chilli powder (*berbere*), stew, bread, and tea.<sup>2</sup>

## Medicinal Uses

Thyme (from *T. vulgaris* and *T. zygis*) is primarily used for cough and bronchitis.<sup>5</sup> It is also used for pertussis (whooping cough), soar throat, colic, dyspepsia, chronic gastritis, diarrhea and enuresis in children, dyspnea, rheumatism, skin disorders, as an appetite stimulant, antiflatulent, diuretic, urinary disinfectant, and anthelmintic. It is also used topically for upper respiratory tract mucous membrane inflammation, laryngitis, tonsilitis, stomatitis, and

halitosis.<sup>3</sup>

Thymol obtained from thyme is an ingredient of pharmaceutical preparations such as cough drops, gas remedies, counterirritants, mouthwashes (main ingredient in Listerine®).<sup>6</sup>

In Ethiopia, both *T. schimperi* and *T. serrulatus* find many traditional uses. The solution from the boiled leaves is drunk for cough, headache, stomachache, and gonorrhea.<sup>2</sup> *T. serrulatus* is topically used for chloasma. It is used internally for ascariasis, taeniasis, tinea captis, toothache, rheumatic pain, mental illness, as an emenagogue, vermifuge, antispasmodic, and emetic.<sup>7</sup>

There is some evidence to indicate that thymol in *Thymus* species has anti-worm activities.<sup>6</sup> The volatile oil and flavonoid constituents are responsible for the antispasmodic, antitussive, and expectorant effects. Thymol has demonstrated anthelmintic activity. Thymol and carvacol have antibacterial and antifungal properties.<sup>3</sup>

### Dosage and Adverse Reactions

The common oral dose of thyme (*T. Vulgaris* and *T. zygis*) is 1 to 2 gm of the dried leaves/flowers several times daily, or one cup of tea (1 to 2 gm of the dried leaves/flowers steeped in 150 ml of boiling water for 10 minutes, and then strained) several times a day as needed, not to exceed 10 gm of the dried leaves (equivalent to 0.03% thymol) per day. For the dried extract, 1 to 2 gm up to three times a day is taken. As a gargle or compress, 5 gm of the leaves is steeped in 100 ml of boiling water and then strained. For thyme oil, 2 to 3 drops are taken orally two to three times a day. Topically, the oil is applied as needed as 1% to 2% ointments.<sup>3</sup>

When used topically, thyme oil can cause skin and mucus membrane irritation, chelitis and glossitis. When taken orally, it can cause nausea, vomiting, gastric pain, headache, dizziness, convulsions, coma, cardiac and respiratory arrest.<sup>3</sup>

### Summary and Comments

Thyme is an important culinary herb. Among many of its medicinal uses are included its use for whooping cough, gastrointestinal problems, and as an anthelmintic.

In Ethiopia, Abyssinian thyme (*T. schimperi* and *T. serrulatus*) is used as food flavor and in teas. It is also used in folk medicine. The use of thyme for cough, stomachache and worm infection in Ethiopia corresponds to the comparable use of the related *T. zygis* (botanically and chemotaxonomically) in other societies.

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***Trachyspermum ammi* (Linn.) Sprague, syn  
*Carum copicum* Hiern. *Ptychotis ajowan* DC,  
*Trachyspermum copticum* (L.) Link  
(Family: Apiaceae or Umbelliferae)**

**Common Name (s):** Bishop's weed, Carum, Ajowan,  
Ajowan caraway, Ajowan seed, Ajava seeds,  
Yavani (Sankrist), Ajowanj (Hindi), Omum,  
Weed-seed, Ethiopian caraway

**Vernacular Name (s):** Netch azmud (A); Azmud-addi, Kamon,  
Kamuni (O), Azmud, Camun (T),  
Gumur-hurtui (S)

### **General Notes, History, and Legends**

"*Trachyspermum*," (= rough seed) which is derived from the Greek "trachys" (= rough) and "spermum" (= seed) refers to the rough texture of the fruits. "Ammi" (from the Greek "ammos"= sand) refers to the original sandy habitat of the plant.<sup>1</sup>

### **Botany and Geographic Distribution**

*Netch azmud* is a smooth or slightly branched annual or perennial herb, which grows to a height of 90 to 160 cm.<sup>1,2</sup> The oval fruits are one-seeded. The aromatic seeds are grayish-brown in color. The plant has small white flowers. It is an aromatic spice, resembling thyme in flavor.<sup>1</sup>

The origin of *T. ammi* is not known. It is endemic in Egypt and Ethiopia.<sup>1</sup> It is also grown in India, mainly in Gujarat and Rajasthan, at higher altitudes.<sup>2</sup> It is cultivated in North Africa, Asia, Ethiopia, India, Iran, and in some parts of Europe.<sup>1</sup>

Ethiopia is the center of diversity for *netch azmud*, which was introduced into the country long time ago.<sup>3</sup> It grows at altitudes of about 1,700 m. It is often cultivated along with barley and *teff*. It is cultivated as a field crop in Bale, Begemdir, Eritrea, Gojam, and Shewa. Small-scale cultivation is rather widespread. *Netch azmud* is sold in every local market.<sup>1</sup>

## Chemical Constituents

The fruits of *T. ammi* in general yield 2% to 4% essential oil, of which 35% to 69% is the phenolic constituent thymol.<sup>2</sup> Ethiopian fruits contain 9% essential oil, of which 55% is thymol. The Seychelles variety contains 10% essential oil, with the thymol constituent being 50%. An Indian cultivar contained 10% essential oil, comprising of 60% thymol.<sup>1</sup> The non-thymol fraction (about 45% of the essential oil) of *T. ammi* is termed thymene, which is a mixture of *p*-cymene,  $\gamma$ -terpinene,  $\alpha$ -pinene,  $\beta$ -pinene, dipentene,  $\alpha$ -terpinene, and carvacrol. A variety of other compounds have also been isolated from the plant.<sup>2</sup>

## Culinary Uses

The use of *T. ammi* as a household medicinal remedy must have led to its use as a spice. Traditionally, it has been used as a spice and a preservative. The fruits (seeds) are used to flavor curries, pickles, biscuits, confections, and beverages.<sup>2</sup> They have an aromatic smell and a pungent taste. In India, the fruits are used as a condiment, and they are exported to Great Britain, Japan, Germany, and the USA. Thymol, a constituent of the fruits, is added to foods as a preservative, and is widely used in the manufacture of toothpastes and elixirs.<sup>1</sup>

In Ethiopia, *netch azmud* fruits are common ingredients of spice mixtures, especially to reduce the pungency of capsicum pepper. They are also used as a flavoring spice in curry sauce (*alicha wot*), and in breads. The fruits are dried, roasted and ground before use. The fruits are sometimes used in the preparation of *katikala*, before fermentation and distillation. *Netch azmud* is also used to make special breads in certain celebrations like the Ethiopian New Year, Feast of Assumption and other religious ceremonies.<sup>1</sup>

## Medicinal Uses

The seeds of *T. ammi* have been used by Indians for gastrointestinal problems, like diarrhea, dyspepsia, flatulence, and indigestion. "Ajowan oil" is also used in India as an antiseptic to treat nasal catarrh and as an antifungal for skin infections. In dentistry, it is used in mouthwashes, gargles and toothpaste preparations. *T. ammi* is

also used as an insecticide and anthelmintic. It has been shown to possess activity against *Salmonella typhosa*, *Micrococcus pyogens* var. *aureus*, and *Escherichia coli*. In Aryuvedic medicine, the herb is used to treat atrophy, cachexia, spasms, and rheumatism. Various lung ailments are also treated with this plant.<sup>1</sup>

An extract of *T. ammi* has been shown to inhibit arachidonic acid-induced platelet aggregation. The plant has also been reported to exhibit antifungal properties, as well as inhibitory effect on hepatitis C virus (HCV).<sup>2</sup>

In Ethiopia, the fruits and roots of *netch azmud* (mixed with other spices) are used to treat stomach problems. In addition, the fruits are used as a vermifuge and as an abortive.<sup>1</sup>

### Dosage and Adverse Reactions

There are no reported dosages and adverse reactions.

### Summary and Comments

*T. ammi* has been used as a spice, preservative and medicinal agent. It is used to flavor foods and beverages. It has also been used as a remedy for GI ailments, as an antiseptic, and anthelmintic. The plant has been shown to demonstrate antibiotic actions. Its activities in the GI tract as a carminative, stimulative, tonic, antispasmodic, and parasympathomimetic have been shown in animal studies.<sup>2</sup>

Ethiopia is deemed to be a center of diversity for *T. ammi*, although it is also indigenous in other areas. *Netch azmud* is locally used in the preparation of the common spice pepper mixture (*berbere*) to reduce the pungency of the latter. It is also used in curry sauce, breads and in the preparation of *katikala*, so-called Ethiopian Vodka. It is mixed with other spices and used in traditional medicine for stomach complaints. It is also used as anthelmintic and abortive agent. There is no scientific report in the literature to support the effectiveness of *netch azmud* use in Ethiopia. However, the use of the plant as a vermifuge and for stomach problems in other countries parallels similar use in Ethiopia.

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***Trigonella foenum-graceum* L.**  
**(Family: Leguminosae)**

**Common Name (s):** Fenugreek, Greek hay, Greek hay seed,  
Foenugreek, Trigonella, Bird's foot,  
Goat's horn, Cow's horn

**Vernacular Name (s):** Abish

**General Notes, History, and Legends**

In Latin, *Trigonella* means "little triangle," referring to the triangular shape of the small flowers. The specific epithet *foenum-graecum* means "Greek hay," a name given by the Romans, due to the fact that they got the plant from Greece. Fenugreek is called "goat's horn," or "cow's horn," because of the horn-shaped pods, which enclose the seeds. The seeds are used as a spice, food for humans, forage for cattle, and for medicinal purposes.<sup>1</sup>

Fenugreek is one of the earliest cultivated plants. It was an ingredient of the "holy smoke," which the Egyptians used in fumigation and embalming. In 812 A.D., Charlemagne encouraged its cultivation in central Europe.<sup>1</sup>

**Botany and Geographic Distribution**

Fenugreek is an annual herb.<sup>2</sup> It is 1 to 2 ft tall, has green leaves, and produces 4 to 6-in pods, each enclosing 10 to 20 small seeds. The hard seeds are yellowish-brown, smooth, oblong, and about 1/8 in long.<sup>1</sup>

The plant is native to western Asia and southeastern Europe. It is cultivated in the Mediterranean area, India, and North Africa.<sup>1</sup>

In Ethiopia, *abish* is grown in all parts of the country at altitudes between 1,800 and 2,200 m above sea level. *Abish* is sold in almost every market.<sup>3</sup> The seeds are sown in August, and harvested 3 to 4 months later. The plants are dried, threshed, and stored.<sup>4</sup>

**Chemical Constituents**

The leaves of fenugreek contain a number of saponins such as

glycosides of diosgenin. The compound diosgenin, which is extracted from the seeds, is used as a natural precursor in the commercial synthesis of steroids, like sex hormones and contraceptives. The seeds also contain coumarins, alkaloids (trigonelline, gentianine, carpaine), C-glycoside flavones (vitexin, isorientin), steroid sapogenins (smilagenin, sarsasapogenin, and yucagenin). A foul smelling fixed oil (8%) occurs in the seeds. During roasting of the seeds, the alkaloid trigonelline breaks down to nicotinic acid and pyridine compounds. These compounds are in part responsible for the flavor of the seeds.<sup>2</sup>

### Culinary Uses

Fenugreek is an ingredient of various spice blends. It is used as a flavoring agent in imitation maple syrup, food, beverages, and tobacco.<sup>5</sup> It is also an important component of curry powders.<sup>1</sup>

In Ethiopia and Egypt, fenugreek is a popular ingredient of bread.<sup>1</sup> In Ethiopia, it is often added to *wot*. It is the second most important spice in the country. It is also used as an appetizer and a milk substitute for babies.<sup>3</sup> It is used in the preparation of barley flour (*ye gebis duqet*),<sup>6</sup> hot spiced powdered peas (*mitin shiro*),<sup>7</sup> mildly spiced powdered peas (*netch shiro*),<sup>8</sup> ground fish stew (*yasa minchet abish*),<sup>9</sup> mushroom sauce (*ye inguday wot*),<sup>10</sup> and split pea sauce (*ye kik wot*).<sup>11</sup>

### Medicinal Uses

In folklore, fenugreek seeds have been used to reduce fever, promote lactation, and to treat mouth ulcers, boils, bronchitis, cellulitis, tuberculosis, chronic coughs, chapped lips, and cancer. They have also been used to reverse baldness. In addition, they are used for lowering blood glucose in diabetics, for improving loss of appetite, for treating dyspepsia, gastritis, constipation, and high cholesterol and triglyceride levels. Fenugreek is applied topically as a poultice to treat local inflammation, myalgia, lymphadenitis, gout, wounds, leg ulcers, and edema.<sup>5</sup>

It is believed that when taken orally, fenugreek is possibly effective in lowering blood glucose levels in diabetics, and in improving loss of appetite.<sup>5</sup> A number of reports have indicated the

hypoglycemic effect of fenugreek seed in diabetic dogs.<sup>2</sup> It may also be effective when applied topically for inflammation. A constituent of the seeds, 4-isoleucine, is believed to directly stimulate insulin. Some studies suggest the seed powder can reduce serum cholesterol level in people with diabetes.<sup>5</sup>

In Ethiopia, *abish* is used as a carminative and tonic for gastric troubles. It is also used to treat rheumatism.<sup>3</sup> The soothing mucilage, which is obtained by soaking the seeds in water, is believed to help in digestion.<sup>1</sup>

### Dosage and Adverse Reactions

The typical oral dose for fenugreek is 1 to 2 gm of the seed three times daily, or one cup of the tea several times daily. The tea is prepared by steeping 500 mg seeds in 150 ml cold water for three hours, and then straining. The upper dosage limit is 6 gm per day. For topical use as a poultice, 50 gm of the powdered seed is mixed with 0.25 to 1 liter of hot water to a paste consistency.<sup>5</sup>

When taken orally, fenugreek can cause diarrhea and flatulence. Larger doses can cause hypoglycemia. Inhalation of the powder can cause allergic symptoms, such as running nose, wheezing, and fainting. Topical use on the scalp can cause head numbness, facial swelling, and wheezing.<sup>5</sup>

### Summary and Comments

Fenugreek is another important ingredient of spice blends, and a flavoring agent in foods and beverages. Like many other spices, fenugreek has a long list of medicinal uses. It is deemed to be possibly effective when used to reduce blood sugar in diabetics, to improve appetite, and when used topically for local inflammation. However, there is no reliable information on the effectiveness of fenugreek for its other uses.<sup>5</sup>

In Ethiopia, fenugreek (*abish*) is a popular spice, especially in the preparation of bread. It is also used to flavor *wot*. In folk medicine, it is used as an appetizer, which is in accord with similar use in other cultures and literature report on effectiveness.

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***Zingiber officinale* Rosc.**  
**(Family: Zingiberaceae)**

**Common Name (s):** Ginger

**Vernacular Name (s):** Zingibil; jinjibil

**General Notes, History, and Legends**

“*Zingiber*” is derived from the Sanskrit *singabera*, which means “shaped like a horn,” because of the resemblance of the roots of the plant to a deer’s antler.<sup>1</sup> “*Officinale*” is obtained from the Latin *officina*, which means “workshop,” or “in the pharmacy” to indicate the medicinal importance of the plant.<sup>2</sup>

The Chinese philosopher Confucius mentioned ginger as early as the middle of the 1<sup>st</sup> century B.C. The Greek physician Dioscorides in his *De Materia Medica* described ginger as a medicinal plant.<sup>1</sup> Ginger is also mentioned in the Koran (76:15-17):

“Round amongst them are passed vessels  
of silver and goblets made out of glass...  
a cup, the admixture of which is ginger”

Ginger was known in England before the Roman Conquest. It was the first Oriental spice to be introduced from the East to the New World. In the Middle Ages, a street in Basel, Switzerland, was named “Ginger Alley,” a place where ginger was sold. Gingerbread was a favorite confection in the court of Queen Elizabeth I. Gingerbread was so popular in England that Shakespeare mentions it in *Love’s Labor Lost*, Act V, Scene I, where Costard tells Moth:

“An I had one penny in the world, thou  
shoudst have it buy ginger-bread.”

English tavern keepers supplied ginger powder to their customers to be added to their beer, or ale to make a palatable drink.<sup>1</sup>

## Botany and Geographic Distribution

Ginger is a creeping plant on a thick tuberous rhizome, which spreads underground. In the first year, a green, erect, reed-like stem about 60 cm high grows from the rhizome.<sup>3</sup> The flower terminates in a long, curved spike, from which grow white, yellow, or purple flowers.<sup>3,4</sup> It has narrow leaves, about 15 to 15 cm long.<sup>3</sup>

Ginger is indigenous to southeastern Asia, and is cultivated in the USA, China, West Indies, and tropical regions.<sup>3</sup> India, Taiwan, Nigeria, Jamaica, Sierra Leone, Mauritius, and Austria are the major producers of ginger. In the tropics, it is cultivated at altitudes of up to 1,500 m above sea level.<sup>2</sup>

In Ethiopia, ginger has been known perhaps since the 13<sup>th</sup> century, when the Arabs brought it from India to East Africa. However, it was little used, and was not grown until much later. Today, it is widely used and sold in most local markets. It is grown mostly in home gardens in Keffa, Illubabur, Gamu Gofa, Sidamo, and Wollega. It is often cultivated at sub-optimal altitudes of up to 2,000 m above sea level.<sup>2</sup>

## Chemical Constituents

Ginger contains an aromatic volatile oil in a concentration of 1% to 3%. The pungent vanilloids are in general called gingerols. They occur at levels of less than 1% of the root by weight.<sup>4</sup> It also contains two other phenolic compounds called shogaols and zingerone, in addition to (6)-gingerol.<sup>5</sup> The other pharmacologically active constituents include (6)-shogaol [dehydroxylated analog of (6)-gingerol], (6)- and (10)-dehydrogingeridone, and zingerone.<sup>4</sup> High amounts of iron (54-62 mg/100 g) and calcium (1%-1.5%) are found in ginger rhizomes.<sup>5</sup>

## Culinary Uses

Ginger has a wide spectrum of uses as a culinary spice. It is available in ground, cracked (broken into pieces) forms, or as a whole. It is used in gingerbread, pies, cookies, pickles, pickling vinegar, flavored syrups, and in the preparation of Oriental meat-based recipes.<sup>1</sup> Ginger is also used as an ingredient of curry powder, and to flavor

ginger beer, ginger wine, and various confections.<sup>2</sup> In the United States, fresh and dried roots of ginger have a GRAS status in foods. The maximum level in foods is 0.023%.<sup>6</sup>

In Ethiopia, ginger is a popular spice. The fresh rhizome is washed, scraped, chopped into bits, pounded, and the resulting product used as it is before, or after drying. The spice obtained in this manner is used along with other spices in *wot*. It is also used in alcoholic drinks, and to flavor tea.<sup>2</sup>

## Medicinal Uses

In folk medicine, ginger is used as a carminative, expectorant, and astringent.<sup>3</sup> It is also used for motion sickness, colic, dyspepsia, flatulence, rheumatoid arthritis, loss of appetite, nausea and vomiting, anorexia, upper respiratory infections, cough, and bronchitis. Topically, the juice is used to treat thermal burns. In Chinese medicine, ginger is used as a diaphoretic, diuretic, stimulant, for treating stomachache, diarrhea, nausea, cholera, and bleeding. Fresh ginger is taken orally for acute bacterial dysentery, baldness, malaria, orchitis, poisonous snake bites, rheumatism, and toothaches.<sup>6</sup> Various medicinal uses of ginger in Africa have been reported. In South and East Africa, ginger is used against headache, coughs, as a galactogogue, mosquito repellent, and mixed with other ingredients as a wound dressing. In West Africa, it is used for catarrh, rheumatic pains, toothache, fever, neuralgia, eye disease, bruises, delaying poison spread, relief of thirst, as a tonic and stomachic.<sup>2</sup> Pharmaceutically, the oleoresin ingredient of ginger is used in digestive, laxative, antitussive, antiflatulent, and antacid preparations.<sup>3</sup>

The antioxidant, antitumor, and anti-inflammatory properties of ginger, all attributable to the pungent constituents, have been reported in the literature. Experimental animal data suggest positive effect of ginger on plasma lipid composition, and thus may be helpful in preventing arteriosclerosis. In a human study, ginger has been shown to be as effective as metoclopramide in preventing nausea and vomiting.<sup>5</sup>

In Ethiopia, ginger has a number of ethnomedical uses. The fresh rhizome is chewed as a cure for infected uvula.<sup>2</sup> The powder is

added to tea and drunk as a medicine for cough. It is also taken with *feto* (*Lepidium sativum*) for the relief of stomachache.<sup>7</sup> It is a component of various multi-ingredient herbal prescription formulae.<sup>8</sup>

### Dosage and Adverse Reactions

The commonly reported oral dosage of ginger is 3 to 10 gm of the fresh root daily. For motion sickness, 1,000 mg is taken 30 minutes before travel, and 500 mg thereafter as needed. As a digestive aid, a decoction which is prepared using two teaspoons powdered or grated root per cup of water, is taken three times a day.<sup>9</sup>

There are no reports of severe toxicity associated with ingestion of ginger, although large overdoses may carry the potential for causing central nervous system depression and cardiac arrhythmia.<sup>4</sup> The safety issue of ginger use in pregnant women, for example in the treatment of pregnancy-related nausea, is not yet settled. There are conflicting reports on the effect of ginger in the fetus.<sup>5</sup>

### Summary and Comments

Ginger is a popular spice, both in the East and West. It is versatile as a spice, coming in different forms to flavor various foods, beverages and confections. It is also widely used in the West, Africa and Asia as a medicinal herb. It is one of the most studied plants in the West for its medicinal potential, especially when used for nausea, vomiting and motion sickness. It is possibly effective in preventing motion sickness, sea sickness, or morning sickness. It may also be effective when used for dyspepsia, rheumatoid arthritis, and for the prevention of post-operative nausea and vomiting.<sup>6</sup>

In Ethiopia, ginger (*zingibil*; *jnjibil*) is used to flavor *wot*, alcoholic drinks and tea. Medicinally, it is used for cough, stomach ache, and infected uvula. Although there is no reliable evidence for its effectiveness, there is a suggestion that the constituents gingerols may be responsible for the cough-relieving effect.<sup>6</sup> Ginger is used in China and other African countries for stomachache, which may also provide ethnomedical support for its similar use in Ethiopia.

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## Appendix I

### Miscellaneous spices/condiments used in Ethiopia<sup>1</sup>

Botanical Name	Vernacular Name (s)*	Plant part used; culinary use <sup>#</sup>
<i>Allium ampeloprasum</i> L. (Liliaceae)	Egzier choagoura (A)	Bulb; spice
<i>Apium graveolens</i> L. (Umbelliferae)		Whole plant; condiment
<i>Carum carvi</i> L. (Umbelliferae)		Seed; condiment
<i>Cucumis levigatus</i> Chiov. (Cucurbitaceae)	Yemdir embway	Fruit; condiment in <i>tedj</i>
<i>Jasminum abyssinicum</i> Hochst. ex DC. (Oleaceae)	Messrech, taroarek (A) Teo (O)	Leaf; condiment in drinks
<i>Jasminum floribundum</i> R. Br. ex Fresen. (Oleaceae)	Messerich; tembelel (A) Bilu, kechachelu (O)	Whole plant; condiment in drinks
<i>Lanata trifolia</i> L. (Verbenaceae)	Koshim (A) Midane-bera, suke (O)	Leaf; condiment in milk
<i>Leonitis raineriana</i> De Visiani (Labiatae)	Ye feres zeng, ras kimir (A); Catator (T)	Leaf; condiment in drinks
<i>Majorana hortensis</i> Moench (Labiatae)	Hassab (A)	Whole plant; condiment

**Appendix I (Continued)**

Botanical Name	Vernacular Name (s)	Plant part used; culinary use <sup>#</sup>
<i>Maytenus ovatus</i> (Wall ex W. & A.) Loesener (Celastraceae)	Adad (A)	Fruit; condiment
<i>Myrtus communis</i> L. (Myrtaceae)	Addes (A); Addisa, coddo (O)	Leaf; condiment
<i>Ocimum canum</i> Sims (Labiatae)	Samha (T)	Whole plant; condiment
<i>Papaver somniferum</i> L. var. album DC. (Polygonaceae)	Genbicha (A); Shankore (O)	Seed; condiment in bread
<i>Rosmarinus officinalis</i> L. (Labiatae)	Kora (O)	Leaf; condiment
<i>Rumex abyssinica</i> Jacq. (Polygonaceae)	Meqmeqo	Roots; condiment
<i>Rumex nervosus</i> Vahl. (Polygonaceae)	Embatcho (A) Dangango (O) Hahol (T)	Root; condiment
<i>Salvia schimperi</i> Benth. (Labiatae)	Abbadera (T) Yewusha dimbilal (A)	Whole plant; condiment
<i>Satureja paradoxa</i> (Vatke) Engler (Labiatae)	Tenadam (A) Tossinyi (O)	Whole plant; condiment
<i>Seasum indicum</i> L. (Pedaliaceae)	Selit (A) Zedi (O)	Seed; condiment
<i>Schinus molle</i> L. (Anacardiaceae)	Libanta (O) Barbari-zellim (T)	Fruit; condiment

## Appendix I (Continued)

Botanical Name	Vernacular Name (s)	Plant part used; culinary use <sup>#</sup>
<i>Solanum incanum</i> L. ssp. <i>incanum</i> var <i>unguiculatum</i> (Rich.) Bitter. (Solanaceae)	Embway (A) Angulle (T)	Fruit; condiment in drinks
<i>Sphaeranthus suaveolens</i> (Forssk.) DC. (Compositae)	Arashadiye; holagabis ala-shien (O) Karamut (T)	Whole plant; condiment in in butter
<i>Vaccaria pyramidata</i> Medic. (Caryophyllaceae)	Yebahir qimem (A)	Whole plant; condiment

<sup>1</sup>Adapted from Jansen, *op cit.* pp 256-81.

\*A= Amharic; O=Oromiffa; T=Tigrigna

<sup>#</sup>Some have also medicinal use.

## Appendix II

Equations for calculating approximate herbal doses in infants and children<sup>1</sup>

**Fred's Rule** (applies to infants up to 2 years of age).

$$\frac{\text{Age of infant in months}}{150} \times \text{Adult dose} = \text{Infant dose}$$

**Young's Rule** (for children over 2 years of age)

$$\frac{\text{Age of child in years}}{(\text{Age of child in years}) + 12} \times \text{Adult dose} = \text{Child dose}$$

**Clark's Rule**

$$\frac{\text{Weight of child in pounds}}{150} \times \text{Adult dose} = \text{Child dose}$$

**Surface Area Method\***

$$\frac{\text{Body surface area in sq. m.}}{1.73} \times \text{Adult dose} = \text{Dose for child and adult}$$

<sup>1</sup>Lowenthal W. Pharmaceutical Calculations. Baltimore, MD: The Williams & Wilkns Co.; 1969; pp 140-66.

\*Although difficult to measure routinely without the use of nomogram, this method is the most accurate.

## **Glossary**

**Abortifacient (Abortive):** A drug or material that causes the expulsion of the fetus.

**Abscess:** A circumscribed collection of pus appearing in an acute or localized infection.

**Acne:** Chronic inflammatory disease of the skin glands characterized by papules and pustules.

**Active principles (active components; active constituents):** Chemicals in plants and other products that are responsible for biological or therapeutic activity.

**Afromontane:** African vegetation region of relatively moist cool upland slopes dominated by large evergreen trees.

**Amebiasis:** Infection with ameba (minute one-celled protozoan).

**Amenorrhea:** Absence or suppression of menstruation.

**Analgesic:** An agent that gives relief of pain.

**Annual plant:** A plant that grows from seed, flowers and dies in the same season every year.

**Anthelminthic:** A drug that kills or causes destruction and expulsion of worms.

- Antidote:** An agent that neutralizes a poison or counteracts its effects.
- Antidisenteric:** An agent that prevents or relieves dysentery.
- Antiemetic:** A drug that prevents or relieves nausea and vomiting.
- Antiflatulent:** An agent that removes gas from the digestive tract.
- Antifungal:** A substance that destroys or inhibits the growth of fungi.
- Anti-inflammatory:** An agent that counteracts inflammation.
- Antineoplastic:** An agent that prevents the development, maturation, and spread of neoplastic (tumorous or cancerous) cells.
- Antispasmodic:** An agent that prevents or relieves spasm or involuntary and irregular contraction of the body muscles.
- Antipyretic:** An agent which treats fever.
- Antiscorbutic:** An agent to fight scurvy.
- Aspiration:** The inspiration into the airway of foreign material.
- Astringent:** An agent which precipitates proteins from the surface of cells or mucous membranes producing a protective covering.
- Antitussive:** A drug that prevents or relieves coughing.
- Aphrodisiac:** An agent which stimulates sexual desire.
- Aphthous ulcer:** A white oral sore, or ulcer of unknown cause.
- Arteriosclerosis:** Hardening of the arteries.
- Ascariasis:** Intestinal parasitic infection caused by a group of roundworms and thread worms.
- Asthma:** Difficulty in breathing.
- Astringent:** An agent that has a constricting or binding effect, for example, one which checks hemorrhages, secretions, etc.
- Atrophy:** A wasting of tissues, organs, or the entire body.
- Boils:** A painful nodule formed in the skin by circumscribed inflammation of skin tissues, enclosing a central slough or core. Also called "furuncle."
- Botanical remedies:** Medicines obtained from plants.
- Bradycardia:** Slow heartbeat.
- Bronchitis:** Inflammation of the bronchial mucous membrane.
- Cachexia:** Weight loss or wasting of the body due to a chronic disease or emotional disturbance.
- Callus:** Hardened skin (thickening of circumscribed area of horny layer of the skin).

**Cardiotonic:** A general term to indicate beneficial effects on the heart.

**Carminative:** An agent which releases flatulence, digestive colic, and gastric disorders.

**Cathartic:** An active purgative, producing bowel movements.

**Carminative:** A substance which prevents formation of, or promotes expulsion of flatus (wind generated in the stomach or bowels).

**Cellulitis:** Inflammation of the cellular and connective tissue.

**Chloasma:** Pigmentary skin discoloration usually occurring in brown patches and spots.

**Chlorosis:** A form of iron-deficiency anemia.

**Cholagogue (choloretic, cholecytagogue):** An agent which increases the flow of bile into the intestine.

**Cholrectic:** An agent which increases the secretion of bile by the liver.

**Colic:** Spasmodic pain affecting smooth muscles in the intestine and urinary tract.

**Colitis:** Inflammation of the colon (large intestine).

**Constipation:** Infrequent defecation with passage of unduly hard and dry fecal material.

**Contraceptive:** A drug or method that prevents conception.

**Contraindication:** Any symptom, circumstance or drug indicating the inappropriateness of a form of treatment otherwise advisable.

**Convulsion:** A violent spasm or series of jerking of the face, trunk, or extremities. Seizure.

**Corn:** Horny induration and thickening of the skin, hard or soft, according to location.

**Counterirritant:** An agent that causes irritation or a mild inflammation of the skin in order to relieve deep-seated inflammatory process.

**Cramp:** A painful spasm.

**Decoction:** A liquid medicinal preparation made by boiling vegetable substances with water.

**Cystitis:** Inflammation of the urinary bladder.

**Cytotoxic:** detrimental or destructive to the cells.

**Decongestant:** An agent that reduces nasal congestion.

**Delirium:** A state of mental confusion and excitement characterized by disorientation for time and place, usually with illusions and hallucinations.

**Depurative:** An herb that gradually stores the proper functioning of the body and increase health and vitality. A synonym for “alterative.”

**Dermatitis:** Inflammation of the skin evidenced by itching, redness, and various skin lesions.

**Diaphoretic:** An agent that produces or promotes sweating.

**Diarrhea:** Frequent passage of abnormally watery bowel movements.

**Digestant:** An agent that will digest food or aid in digestion.

**Disseminated Intravenous Coagulation (DIC):** Uncontrolled clotting of blood throughout small blood vessels leading to tissue necrosis and bleeding.

**Diuretic:** An agent which increases the secretion of urine.

**Dropsy:** Morbid accumulation of water in the tissues and cavities.

**Dysentery:** Intestinal disorders characterized by inflammation of the mucous membrane.

**Dysmenorrhea:** Painful or difficult menstruation.

**Dyspepsia:** Imperfect digestion caused by disease, or disorders.

**Dysurea:** Difficulty or pain in urination.

**Eczema:** Acute or chronic cutaneous inflammatory condition with erythema, papules, vesicles, pustules, scales, crusts, or scabs alone or in combination, which may be dry or wet.

**Edema:** The accumulation of excess fluid in a fluid compartment.  
Also called dropsy or hydrops

**Elephantiasis:** Swelling of the legs and genitalia caused by filarial worm (also called “filariasis”).

**Embalm:** To treat a dead body with balsams and other materials to preserve it from decaying

**Emenagogue:** A substance which promotes or assists the menstrual flow.

**Emetic:** An agent that produces vomiting.

**Emphysema:** Breathlessness on exertion.

**Endemic:** Occurring only in a certain region or country.

**Enuresis:** Incontinence (failure to urinate) without an organic cause.

**Esophagitis:** Inflammation of the esophagus.

**Euphoria:** An exaggerated feeling of well-being.

**Evergreen:** Plants having foliage that remains green and functional through more than one growing season.

**Expectorant:** A substance that facilitates the removal of secretions of the broncho-pulmonary mucous membrane.

**Extract:** A solid or semi-solid obtained by extracting the soluble portion of a plant material with a fluid, followed by evaporation of the solution.

**Fixative:** An agent which assists in retaining the aroma of other substances.

**Flatulence:** Excessive gas in the stomach and intestines.

**Fluid extract:** An hydroalcoholic extract which contains in 1 ml 1 g of plant material

**Flora:** Plants found in a certain region.

**Furuncle:** Localized infection originating in a hair follicle.

**Galactogogue:** An agent that increases the flow of milk from lactating woman

**Gastroenteritis:** Inflammation of the mucous membranes of both the stomach and intestine.

**Gingivitis:** Inflammation of the gums characterized by redness, swelling and tendency to bleed.

**Gargle:** A wash for the throat.

**Gastric squamous cell carcinoma:** Slow growing tumor of epithelial cells of the stomach.

**Gastritis:** Inflammation of the stomach.

**Gastroenteritis:** Inflammation of the stomach and intestinal tract.

**Glossitis:** Inflammation of the tongue.

**Gout:** A metabolic disease marked by arthritis and inflammation of the joints.

**Gum:** A translucent and amorphous plant-derived complex substance produced by the plant as a protective after injury.

**Halitosis:** Offensive breath.

**Heartburn:** Burning sensation in the esophagus, or below the sternum in the region of the heart.

**Hemorrhage:** Abnormal internal or external discharge of blood.

**Hemorrhoids:** Dilated blood vessels in the anal region liable to discharge blood.

**Hemoptysis:** Spitting of blood or blood-stained sputum.

**Hepatic:** An agent which affects the liver harmfully or correctively.

**Hepatitis:** Inflammation of the liver of virus or toxic origin.

**Hepatocarcinoma:** Malignant hepatoma (cancer or neoplasm of the liver).

**Hernia:** Protrusion of a part or structure of the body through tissues normally containing it.

**Hiatal hernia:** Protrusion of a part of the stomach through the esophageal hiatus (opening) of the diaphragm.

**Hydrolysis:** A chemical reaction where water is one of the components, and by which simpler compounds are formed.

**Hydrophilic:** Showing affinity to water molecules.

**Hypercalcemia:** Excess of calcium in the blood.

**Hyperthermia:** Unusually high fever.

**Hypoglycemia:** Abnormally low concentration of glucose in the blood.

**Impotence:** Weakness, especially inability of the male to achieve or maintain erection.

**Indication:** A sign or circumstance which indicated the proper treatment of a disease.

**Inflammation:** A pathologic process involving cells and blood vessels in response to injury or abnormal stimulation caused by a physical, chemical or biological agent.

**Infusion:** A product obtained by steeping a substance in hot or cold water in order to obtain its active principles.

**Inhalation:** A product inhaled into the respiratory tract by breathing in.

**Insomnia:** Chronic inability to sleep, or sleep interrupted by periods of wakefulness.

**Irritable bowel syndrome:** A motility disorder involving the entire

**Gastrointestinal tract (GI)**, causing abdominal pain, constipation and/or diarrhea and abdominal bloating.

**Lacrimation**: The secretion of excess milk.

**Laryngitis**: Inflammation of the mucous membrane of the larynx.

**Larvicide**: An agent that kills insect larvae.

**Latency**: The state of being inactive for a transient period.

**Laxative**: An agent that acts to loosen the bowels by facilitating the passage of bowel contents at the time of defecation, and, therefore to prevent or treat constipation.

**Leishmaniasis**: Infection affecting the skin, nasal cavities and the pharynx.

**Leprosy**: An infectious disease resulting from the invasion of nerves by *Mycobacterium leprae*.

**Lethargy**: A state of deep and prolonged unconsciousness resembling profound slumber from which one can be aroused.

**Libido**: Sexual drive, conscious or unconscious.

**Liniment**: A liquid preparation for external application or application to the gums.

**Lipids**: Compounds comprised of fixed oils, fats, and waxes.

**Lumbago**: Pain in the mid and lower back (lumbar rheumatism).

**Materia Medica**: Medical matter; branch of science dealing with all drugs used in the treatment of diseases, their source, preparation, dosage and use.

**Measles**: A highly communicable disease characterized by fever, general malaise, sneezing, nasal congestion, brassy cough, conjunctivitis, spots on the buccal mucosa, and a maculopapular eruption over the entire body caused by rubeola virus.

**Menopause**: Permanent cessation of menses.

**Menorrhagia**: Excessive bleeding at the time of menstrual period.

**Menses**: Menstruation.

**Miosis**: Contraction of the pupil.

**Monograph**: A treatise dealing with a single subject.

**Mucilage**: A natural plant hydrocolloid which is usually translucent, heterogenous and amorphous; forms a slimy mass with water.

**Mucosa**: Mucous membrane, such as that lining the mouth, etc.

**Mumps:** A contagious disease characterized by inflammation of the parotid glands and other salivary glands.

**Myalgia:** Muscular pain.

**Neuralgia:** Severe sharp pain along the course of a nerve.

**Oleoresin:** A resin and volatile oil in homogenous combination.

**Oleo-gum-resin:** An oleoresin and gum homogenous mixture.  
Example: myrrh.

**Orchitis:** Inflammation of the testes.

**Otitis:** Inflamed condition of the ear.

**Oxytocic:** An agent which stimulates uterine contraction during child birth.

**Palpitations:** Rapid, violent, or throbbing pulsation, as abnormally rapid throbbing or fluttering of the heart.

**Periodontium:** The tissues supporting the teeth.

**Perennial plant:** A plant that lives throughout the year every year.

**Pharmacological test:** Test conducted to study the effect of a medicinal agent.

**Phlegm:** Mucus or sputum.

**Photodermatitis:** Sensitivity of the epithelium of the skin to light.

**Phototoxic:** Producing a condition as a result of being overexposed to light in combination with certain substances.

**Physiological:** Concerning body functions.

**Phytochemical:** Chemicals or pertaining to chemicals that are found in plants.

**Phytotherapy:** Treatment using medicinal plants.

**Pleural effusion:** Escape of fluid from the pleural cavity into the surrounding tissue.

**Pimple:** A papule (small circumscribed, superficial elevation of the skin) or a pustule (pus-containing small circumscribed elevated lesion of the skin).

**Pluerisy:** Inflammation of the pleura (the serous membrane enveloping the lungs and the lining of the walls of the pleural cavity).

**Pneumonia:** Inflammation of the lung caused by infection by bacteria, viruses, other organisms, or inhalation of some chemicals.

**Pomade:** A perfumed ointment often used on the head.

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**Pneumonia:** Inflammation of the lung caused by infection by bacteria, viruses, other organisms, or inhalation of some chemicals.

**Pomade:** A perfumed ointment often used on the head.

**Psoriasis:** Chronic, recurrent skin disease marked by discreet bright red macules, papules or patches covered with silvery scales.

**Potency-strength.**

**Potion:** A drink or a dose of poison or liquid medicine.

**Poultices:** A soft, moist mass of plant parts that are wrapped in muslin or gauze and applied warm or hot to the skin.

**Purgative:** An agent that causes watery evacuation of the intestinal contents.

**Rabies:** An acute viral infection mainly of the central nervous system transmitted to man by the bite of a rabid dog, cat, jackal, or bat.

**Rectal prolapse:** Dropping the rectum.

**Refrigerant:** An agent which cools the blood and reduces fever.

**Resin:** An acidic substance that is either a phenolic derivative or an oxidation product of terpenes; usually a solid or semisolid material of complex chemical nature.

**Rheumatism:** A general term for acute and chronic conditions characterized by inflammation, soreness and stiffness of muscles, and pain in joints and associated structures.

**Rhinorrhea:** A discharge from the nasal mucous membrane.

**Rhizome:** An elongated, usually horizontal underground stem bearing buds in the axils of reduced scale-leaves.

**Ringworm:** A common contagious disease produced by fungi that affects the skin, hair, or nails.

**Scabies:** A contagious parasitic disease of the skin caused by the mite *Sarcoptes scabiei*.

**Sciatica:** Neuralgic pain along the course of the sciatic nerve caused by inflammation injury to the nerve.

**Scurvy:** A disease marked by debility, anemia, ulceration, and hemorrhages caused by vitamin C deficiency.

**Sea sickness:** Nausea and vomiting caused by the rolling and pitching of a vessel at sea.

**Secretolytic:** Inhibiting or drying secretions.

**Seizures:** Convulsion; an epileptic attack.

**Sensitization:** A condition of being made sensitive to a specific substance.

**Sprain:** An injury to a ligament when the joint is carried through a range of motion greater than normal.

**Somatosensory:** Sensation relating to the body's superficial and deep parts.

**Steam distillation:** Distillation which uses steam to isolate various plant compounds

**Steep:** To soak in hot water.

**Stomachic:** A medicine which stimulates stomach secretions.

**Stomatitis:** Inflammation of the mouth.

**Stroke:** Sudden neurological condition due to impaired blood flow in the brain.

**Syphilis:** An infectious, chronic, venereal disease characterized by lesions which may involve any organ or tissue.

**Tachycardia:** Rapid beating of the heart.

**Taeniacide:** An agent that kills tapeworms.

**Taeniafuge:** An agent that expels tapeworms.

**Taxon (Taxa):** The name(s) applied to a taxonomic group(s) in a formal system of plant nomenclature. Examples: genus, section, species, subspecies, variety, sub-variety

**Tincture:** Hydroalcoholic solution in which 10 ml contains the active constituents found in 1 to 2 g of the herb.

**Tinea capitis:** A fungal skin disease of the scalp.

**Tonic:** An agent which strengthens and enlivens a specific organ or the whole body.

**Tonsilitis:** Inflammation of a tonsil.

**Toxin:** A noxious or poisonous substance that is formed or elaborated by the body.

**Typhus:** Any of a group of acute infectious diseases characterized by great prostration, severe headache, generalized maculopapular rash, sustained high fever, and usually progressive neurologic involvement, ending in a crisis in 10 to 14 days.

**Tumor:** A swelling or enlargement occurring in inflammatory condition; also called neoplasm.

**Umbel:** A characteristic inflorescence, as in the carrot family

**Urinary retention:** Failure or inability to empty the bladder.

**Uterine prolapse:** A dropping of the uterus.

**Varicose veins:** Permanent dilation of the veins commonly seen in the legs.

**Vermifuge:** An agent that expels intestinal worms.

**Virustatic:** Pertaining to the inhibition of the growth and development of viruses.

**Vitiligo:** Skin condition characterized by milk-white patches, surrounded by areas of normal pigmentation

**Warts:** A circumscribed cutaneous elevation resulting from hypertrophy of the epidermis.

**Whooping cough (pertussis):** An active inflammation of the larynx, trachea, and bronchi caused by *Bordetella pertussis*.

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